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“It will flourish, if naturalists, chemists, antiquaries, philologists, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease.”

SIR WM. JONES.

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## ERRATA IN PART I. 1868.

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- Page 8, l. 16, for 1428 to 1445, read 1457 to 1474.  
52, l. 12, for *dried*, read *dried, white*.  
— l. 13, for *dried*, read *dried, black*.  
120, last line, for *Batesvi*, read *Bateswar*.  
121, 3rd line, for *Gandhan* read *Gandharv*.  
121, 4th line, for *Kalysur* read *Kalyesur*.  
121, 5th line, for *nist* read *niot*.  
121, 8th line, for *Paninko* read *Raninko*.  
121, 18th line, for *Chanhán* read *Chauhán*.  
122, 9th line et passim for *Kharginpur* read *Kharjúrpur*.  
126, 14th line, for *Karuchandra* read *Karuchandra*.  
133, 3rd line, for *chhaná* read *chhona*.  
133, 5th line, for *Sandha* read *Saudha*.  
133, 6th line, for *chhanhahi* read *chhauhahi*.  
133, 7th line, for *Varamchi* read *Vararuchi*.  
133, 16th line, for *Rauran* read *Raura*.  
133, last line, for *Sangins* read *Sanguis*.



# JOURNAL

OF THE

# ASIATIC SOCIETY.

PART I.—HISTORY, LITERATURE, &c.

No. I.—1869.

*Further Notes on the Prithiráj-ráyasa.*—By F. S. GROWSE, *Esq., M. A.*

(Continued from Vol. XXXVII. page 134.)

[Received 17th February, 1869.]

My former paper on the poems of Chand Barday was little more than a bare literal translation, which necessarily repeated the involved style of the original, and left the real points of interest anything but obvious to the casual reader. To remedy this defect, I now propose before proceeding any further in the MS., to indicate some of those features in the first Canto which appear to me most worthy of attention.

The shape into which the poem is thrown, is curious. The whole of it, with the exception of the first 120 introductory lines, is supposed to be a prophecy declared in the remote past by the great sage Vyása to King Anangpál, who solicits further information whenever there occurs a pause in the narrative. The clumsiness of this device, might be considered an indication of antiquity; but in my opinion it is rather due to an affected imitation of the style of the Puránas, which are invariably cast in the form of a dialogue.

The bard begins by announcing his intention to compose a work equal in extent to the Mahábhárat, and which he trusts will soon become equally renowned, and make the name of Chand as glorious

as that of Vyása, since Prithiráj, the hero to be celebrated, was no whit inferior to Duryodhan. He then relates how Anangpál, guided by a happy omen, founded the citadel of Dilli, and sunk an iron column so deeply in the ground, that its point entered into the forehead of Seshnág. Upon the stability of this pillar depended the permanence of the Tomar dynasty; yet the king, impressed by the pretended incredulity of Takshak, Seshnág's brother, who came to him in the disguise of a Bráhmaṇ, allows the pillar to be moved. Terrified at the portents of an impending catastrophe which follow upon his rash act, Anangpál seeks consolation from Vyása, who thereupon discloses to him the whole future course of events, saying :

The Tomar dynasty shall eventually be succeeded by the Chauháns, the latter by the Muhammadans. The last and greatest king of the Chauháns shall be Prithiráj. He shall wage many glorious wars; in particular, one with the Chandel king of Mahoba. Now the origin of the Chandels shall be on this wise: The Gaur line of kings at Kási is succeeded by the Gaharwárs, Karnchandra, Ransiñh, Jagannath, Ransiñh II., Surasiñh and Indrajít. In the court of this last monarch is a Bráhmaṇ, Hemráj. (In another passage this name is written Hansráj.) The moon-god becomes enamoured of his daughter Hemavati. The offspring of this guilty union, Chandra-brahma, becomes the special favourite of heaven, and to console the mother for her disgrace, Brahma promises that her sons from generation to generation shall sit upon the throne so long as they retain the word Brahma as an affix to their name. Chandra-brahma subdues the territory of Kási, founds Kalinjar and Mahoba, and is warned in a vision that his family shall reign at Mahoba for 20 generations. He is succeeded by Bár-brahma, and he again by Pár-brahma and so on for 19 generations, till Parmál the 20th in descent from the moon-god, being ashamed of his family origin, drops the name of Brahma. In consequence, he is deserted by the favour of heaven, and in the war with Prithiráj is worsted by that monarch. The particulars of this war form the subject of the Mahoba-Khand.

I have given the above argument of the poem in order to shew that, however abrupt in execution, it has been deliberately planned, and is built upon a wide and definite basis. I also observe that Bábú Rájendra Lal Mitra, the learned Philological Secretary, who

was kind enough to write a brief abstract of my translation when he laid it before the meeting in October, (see Proceedings for that month, page 246) has failed to catch the thread of the narrative. He evidently considers the legend of Hemavati and the moon as a subordinate incident; whereas it is in fact the real opening of the drama, to which the story of Anangpál and the iron column is only the prologue. I notice this in no spirit of hyper-criticism, but only as my excuse for now repeating in brief what my translation had already shewn in extenso.

The legend with regard to the origin of the Chandels is curious, as explaining the derivation of the word. *Chandel*, or *Chander*, the moon-born, is a patronymic precisely similar in form to *chachera*, the son of a *chacha*, *i. e.* a cousin. (This latter word is now almost banished from polite language, in order to make room for the vile mongrel, *chacha-zád*.) It also explains a genealogical difficulty mentioned by Sir H. Elliot, in his Glossary, who says: "Though the Chandels are styled Sombansi, they are not considered to be of pure descent, and their sons are carefully excluded from marriages with the higher classes." The legend makes it clear, how that in one sense they are truly sombansi, that word being absolutely identical in meaning with chandel, while at the same time their descent is impure.

As Chandra-brahma, the great founder of the race, had a Brahmani for his mother, while his reputed father was the moon, a god more closely connected with Brahmans than Kshatriyas, it does not appear, on the face of the legend, how the Chandels can claim to be Thákurs at all. But a near though unexplained relationship, is always implied to exist between the Chandels and the Gaharwár Thákurs; and as Chandra-brahma's putative father is clearly mythical, while it is known that he was born in a Gaharwár court, it may be presumed that his real father was a Gaharwár. Thus too, his first act on acquiring power, was to avenge his mother's fall by expelling the Gaharwárs from Kási.

The particulars with regard to the succession of dynasties and individual kings at Kási are, I believe, novel, and may be of some historical value. Only one dynasty of Kási kings is specified in the Puránas.

In connection with Kalinjar, mention is made of a famous *tírtha*, called in the Benares MS. *Mrigadhára* (Vol. XXXVII. page 180). This I imagine must be a clerical error for *Mrigá-dáva*, the deer-forest, the legend regarding which place is given in an Appendix to Sher-ring's Sacred City of the Hindus.

I have lately received two MS. fragments of the *Prithiráj-ráyasa*, which have been hunted up for me by Rájá Lakshman Siñh (a Rahtor Thákur) of this district. The one consists of 55 folio pages and is entitled "Srí Kabi Chand virachite Prathiráj-ráisai ke barí beṛí rájá grahano náma kaháo." The date is Sambat 1856. It refers to events in the Muhammadan war, and I have not yet discovered any corresponding section in the Benares text. The second MS. consists of 110 octavo pages, and is headed simply "Samao Mahobe ko." The title is given more fully at the end thus "Srí Mahobe juddh rájá Parimál Prithiráj Mahobe-Khand varnanam Alha-Khand Chand Kabi virachitam." The date of the copy is 1881, Sambat.

It omits the introductory legend of Anangpál and the Iron Pillar, with the genealogies of the Chandels and Banáphars, which constitute the two first cantos of the Benares MS., and relates instead how Prithiráj carried off Padmávati, the daughter of Prince Padma-sen, from Samud-Sikhari, a strong fort in the east.\* On his way back to Dilli, he falls in with the Pathán forces under Sahab-ud-din and Momrez Khán of Khurasán† and defeats them with great loss. He is obliged however to leave 50 of his own wounded on the field, who with a few other Rájputs under Gun-manjari, Kanak Siñh and Sardár lose their way and wander off to Mahoba, where they proceed to encamp in one of king Parmál's gardens. All this is omitted from the Benares MS., the third canto of which begins in a very confused way with the arrival of the 50 wounded men at Mahoba. The rape of Padmávati and the engagement with the Muhammadans receive only such casual mention as would be quite unintelligible, if the other MS. had not supplied the missing details.

From the 3rd to the 13th canto, the two narratives may be said to coincide, since with the exception of a very few occasional lines,

\* The date is given as 1130 Saka—Gyára Sai das bís Sakhá Sambat parínamam—this must be an error, unless some local era is intended.

† In describing the Muhammadan army, occurs the following line. Panch salas aswár, agenti golam, i. e. 5000 horse and artillery innumerable.

the Mainpuri MS. contains nothing which is not also to be found in the Benares MS. It omits, however, a great deal; yet the excision is generally so cleverly made, that the loss would not be noticed, were there no other copy at hand for collation. Take the following passage as a specimen (Mainpuri MS. page 29).

"The army of the Chauháns has come ready for battle; prepare ye to meet them. Leave untried neither charm nor spell, nor aught else that may avail." Spoke Queen Malhan and said: "Delay the battle, O king, for two months; send Jaganak to summon Alhan, and collect the materials of war." All accepted the Queen's advice, saying, "Make proffers of friendship to Prithirāj, send Jalhan to present him with a *nazr*, and invite him to an interview." So they sent 5000 leaves of betel, &c., &c.\* These ten lines are coherent enough, but in the Benares MS., canto 8, they are widely scattered; 20 additional lines occur after the word 'avail'; 70 after 'war,' and 8 after 'interview.'

The way in which these two MSS. mutually supply each other's deficiencies, while at first sight they appear altogether dissimilar, is highly interesting; since it affords a complete refutation to a theory which has prevailed in some quarters, *viz.* that such fragmentary pieces form the genuine Chand ballads, and that the complete poem is a much later and comparatively worthless compilation. The comparison now made, shews in the clearest light that the two MSS. under consideration, and it may be presumed their fellows also, have been extracted from some one large and ancient original; and that the great epic, in some such form as we see it in the Agra copy, is not an accretion of ballads, but the genuine production of a single poet, which all later generations of bards have freely plundered.

Wherever the two MSS. coincide, the verbal differences of reading are found to be very numerous; as will appear from inspection of the following parallel passages, wherein is described the commencement of Parmál's attack on the 50 wounded Chauháns, who had encamped in one of the royal gardens.

\* In the list of offerings occur the words 'badhúkh, barakshi:' the latter no doubt is for *barchhi*, a spear; the former perhaps a corruption of *badhaka*, destructive, and the origin of the modern *bandúk*, a gun, the derivation of which word has never before been ascertained. In the Benares MS. the corresponding word is *mahoksh*, an ox.

Extract from page 14 of Rājā Lakshman Siñh's MS.

कंदमोतीदाम कियोपरिमालऊकुंमुजुसाजि  
 चलेसवरावतजंगकोंगाजि  
 चलेजुवनाफरमुखजुशूर  
 वधेले अरुगहलोतकरूर  
 चलेभरजागरामलहनजोइ  
 सजेभरजदममदमहोइ  
 निवाजियवैसनरेसऊकुंम  
 सनंमुखसकसुवकउकुंम  
 चलेहरिदासवधेलेवल्लिख  
 पमारवरसाथ उचारव इछ  
 सुनीरजपूतनिवातकुण्डग  
 वधकसि आयुध आयुध अंग  
 कसेरजपूतसुन्यातवधेर  
 सुनौपरिमालकरौजिनिवैर  
 सुनेचऊवाननकाडहिदाउ  
 करौमति अब्बचदेन उपाउ  
 करौचऊवानसोंकाजविरुद्ध  
 भजौतजिघेतसहैनहिजुद्ध  
 येसोसुनिवानोकियेरतनैन  
 कह्यौनपमारऊमारऊवैन  
 चलीसवसाजिचंदेलकीफौज  
 पिलेरजपूतसनंमुखचौज  
 मिलीजवदृष्टिसों दृष्टिकरूर  
 मिलेरजपूतजुमदमरूर  
 मिलेमुघ आइमुकालवज्जान  
 उकारत आयुधकूटतमान  
 लगेसरसोइककृत्तिय आइ  
 किधोंविष आसीयकासीयपाइ  
 लगउर आइसकत्तीयसेल  
 करेदोऊवीरयहेविधिघेल

कटक्कटघाइलखग्निकाटि  
 घटक्कतसेलनिषेलनिराट  
 गटक्कतिगिधिनिचोटियदैरि  
 घटक्कतघाइल दाइलमोरि

Here follows the corresponding passage from canto III. of the Benares MS.

कंदमोतीदाम कियौपरमालज्जकुमसोरज्ज  
 चलेसबरावतजंगकौसज्जि  
 चदेखवनापरमुख्ययसूर  
 वधेलगुहलौतसुलोहगरूर  
 चलेभरजागरामलहनसोइ  
 सजेकरजद्वभेदवहोइ  
 निवाजोयवैसनरेसज्जकुंम  
 सप्पेमुखसक्कसुधंक्रतकुंम  
 चलौहरिदासमहावलइय  
 पचारिवमाथ उचारिवइय  
 सुनीरजपुत्तनवातकुठड्ड  
 ठनं इक्कघाव उपाइसु अट्ट  
 सजेरजपुत्तसुनोजवधैर  
 सुनौपरमालकरौजिनवैर  
 उंचे अतिसैधतहोत्तपराय  
 कल्लौरजपूतनवैनसुनाय  
 सुनौचज्जवाननक्कंडहिदाव  
 करौमति अग्रचदेखउपाव  
 करौ प्रथिराजसांकाहेविषज्ज  
 सुनैत्तपवैनकरेरतनैन  
 कल्लौमुखमारज्जमारज्जसैन  
 कट्टिकिततट्टिकतगीधनदैर  
 पट्टकतधाइलदावलदैर

The present disjointed state of these poems, affords a very striking parallel to the supposed condition of the Homeric ballads, before they were reduced to a definite canon by Pisistratus; and the Homer of

Rājputáná is a title most applicable to Chand, in a sense beyond that which was originally intended. On comparing the above extracts, it will be seen, that each is largely explanatory of the other. The short Mainpuri MS., in several places, presents the preferable reading, and besides supplying the missing half of one couplet, gives ten additional lines which obviate an awkward break in the narrative. There can be little doubt that every district in the North-West, if carefully searched, would yield some three or four similar fragments; and it is obviously desirable that as many of these as possible should be collated, before the Society commits itself to the adoption of a standard text. In all cases, the actual transcript will be of modern date, but it may often have been taken from an older original than that which is represented by the complete copies of the poem. The settlement officer of an adjoining district has been, I believe, engaged for some time past in collecting such fragments of the Alha-Khand, as are popularly current amongst the people in that neighbourhood, and proposes to give an English abstract of their contents. His main object is to illustrate the tone of local traditions; but there can be little doubt that the result of his enquiries will have large philological interest as well.

A variety of causes combine to render it likely that many years will elapse before a satisfactory edition of the Prithirāj-rāyasa can be prepared. Meanwhile, I propose to forward from time to time for insertion in the Society's Journal, translations of such portions of the poem as seem to possess most intrinsic interest. That such a course will not be unacceptable to the small world of Oriental scholars, I infer from the remarks made by the learned and most observant censor of Indian literary progress, M. Garcin de Tassy, who in his interesting and exhaustive review for 1868, speaks of the Prithirāj-rāyasa, in connexion with my proposal for its publication, as '*ouvrage d'une inestimable valeur, non seulement pour l'histoire, mais pour la philologie,*' and concludes by expressing a hope '*que ce poème sera enfin édité, et qu'on songera aussi à en donner une traduction complète accompagnée d'éclaircissements satisfaisants.*' The completion of such a translation may be facilitated by my series of selections.

As Alha and Udal are far the most famous characters in the Mahoba war, I proceed to translate the close of the second canto wherein they are first brought upon the stage.

*Translation of the latter part of Canto II.*

"Thus has been told the full genealogy of the Chandels and Gaharwárs till the incarnation of Valla and Salla in the Kali Yug of creation." Then the stout-hearted king listens while Vyása declares their pedigree. "The two heroes Salla and Valla are manifested in the Banáphar line. Chintá-mani in the hope of a son became absorbed in divine contemplation, and having with his own hands clean severed his head from his body, laid it at Bhava's feet.\* For the space of 12 years Chintá-mani had served S'iva: Káli's lord was gratified at his devotion and taking the head in his hands reunited it to the body. Chintá-mani sprung to life again; S'ambhu called him to his feet: "I am well pleased with thee for ever, ask of me three boons." Said Chintá-mani, "The first boon, an army; the second, gallant leaders; and third, may the sovereignty remain for ever in the house of the Chandels." "In thy family, Chintá-mani, brave heroes are born, such as never have been, nor yet shall be. The boon that thou hast desired, I have granted;" and with a smile, the lord of the five elements† vanished.

In the palace of Chandra-brahma‡ flourished Chintá-mani, a second Agastya, and by the grace of Siva began the series of the incarnations of Valla. After Chandra-brahma arose other glorious kings, and gallant heroes of the Banaphar line ever commanded their armies.§ Chintá-mani and Sasipál served King Chandra-brahma: when Jagat-brahma reigned, Makarand was his trusty counsellor. In the time

\* The original stands thus: Apno sir chhin app kar kal bhú ágá aí. Here *app* may be for *apne*, in which case *kar* will mean *hands*; or it may stand for *arp*, when *app kar* will be equivalent to *arpan karke*. The four words at the end of the line are at first sight very perplexing; but *kal* is little more than an expletive signifying *well* or *clean*, and *bhú* should be written *bhava*, the vowel having been substituted for the cognate consonant.

† *Bhútpati*, lord of the 5 elements. It might also also be rendered 'lord of departed spirits;' but the former sense appears to me preferable; compare the opening lines of the *Sakuntala*.

‡ In the original, Chandra-brahma is here called Sasi-brahma, and further on, Vidhu-brahma; Chandra, Sasi and Vidhu being synonymous terms. The text runs thus: Chintá-mani Sasi-brahma ghar bhaye pragati parwán: but this does not give a very satisfactory meaning, and therefore for *pragati* I have substituted *agati* (Prakrit for *Agastya* as shewn by the name of a village, *Agati-sarée* on the borders of this district). The difference between *प्रगटि* and *अगटि* is almost imperceptible. *Parwán* stands of course for *pranán*.

§ 'Commanders of armies' *baládhiksh*, for *baládhyaaksh*, rather an unusual word.

of Bár-brahma Ankur\* was minister; the adviser of Satya-brahma was the bold Sadá-Chandra.† The generous knight Alha was ennobled by the son of Kírat. From Chandra-brahma to Parmál, there was always a Banáphar in the king's palace. Chintá-mani was famous on earth; his son was the bold Sasipál; then came Kripá-chand and Sabha-chand; Sabhá-chand's son was the fierce Makarand. After him, the world-renowned Akrúr. He begat the heroic Abhayráj, whose son was the valiant Makarand, spoiling the enemy in the crush of battle‡ ..... faithful servant of the Chandel king. His son was Dípchand, perfect in mind and body, a fountain of joy. He begat Santhira, the best of sons, of incomparable prowess on earth. His son was Baghel, winner of many spoils, and his son the famous Jasrath.§ To him were born the twin heroes, Alha and Udal, who, terrible in their wrath, subdued the whole world. In Dasahar's house were manifested the heroic pair Alha and Udal; in their persons Salla and Valla became incarnate in the Banáphar line. Heaven was gracious to the land, gave them the arrow of Garuṣ, and for a second boon an army too vast to be numbered. Finding them ever wakeful to serve him with body and soul, Gorakhnáth bestowed upon them weapons of offence and defence, and made them immortal upon earth. The sons of Suddh-Karan and Jam-Karan were Budhjan and Janpál, to whom were born in the world Mahipál and Bhuvapál.|| They had only to shew themselves to secure submission, and kings obedient to their orders loved them as the apple of their eye.

He who with attentive ears hears the origin of the family of Chandra-brahma, shall receive of Srí Padmávatí fortune and success. He who thrice hears with attention the genealogy of Chandra-brahma, shall obtain whatever blessings are within the reach of humanity, shall have wife and children and all good things on earth, and no

\* 'Ankur.' This no doubt should be *Akrúr*, a name which occurs lower down.

† 'Sadá chandrá.' This and *Sabhá-chand*, which occurs below, evidently denote the same individual: without reference to another MS. it is impossible to say which is the correct form.

‡ Here I have omitted one line which defies all interpretation: *जिनेकांडन-दंतराजंद्राज*. It is probably corrupt.

§ 'Jasrath.' Called below *Dasahar*.

|| This couplet is obscure, and the words given as proper names may be only epithets, but Mahipál and Bhuvapál are mentioned in a later canto as relations of Alha and Udal.

sickness shall ever approach his immaculate body. Knowing this to be the reward, repeat the legend of the moon-god; in no other way can such a result be obtained. Wealth shall abound, your house shall stand fast, and your's shall be the victory in the battle. Whoever shall thrice hear the legend of Chandra-brahma, though childless, he shall have a son with abundance of wealth in a strong house. What Vyása declared to Anangpál, that Chand repeats to the king's family.\* Now the bard† relates in lengthened strain the war between the Chandels and Chauháns.

The subject of the third canto has been already indicated. Parmál assembles a force of Chandels, Solaukhis, Jádavs, Gaharwárs, Gahlots, Bais Thákurs, Jhángrás and Baghels against the 50 wounded Chauháns, and at length succeeds in cutting them to pieces, but not until his army has sustained a loss of 4000 men! The canto concludes as follows :

*Translation of the latter part of Canto III.*

Alhan went home and there in the presence of Udal declared his secret thoughts to his mother: "The king is dull of soul; this land, nay, the whole world knows it; his judgment is gone, he listens only to Mahil." Divalde, on hearing the sound speech of her son Alhan, said "Regard not the errors of the king, but do your duty to your lord. Hanumán did his master faithful service; the whole world reverences Rámá's messenger. Though the king has lost his senses, do not you break his orders." Alhan having heard his mother's advice went to the Court. The king rose trembling, all the Chandel princes made obeisance. Alhan enters the council-chamber and addresses Parmál: "The wounded have been wantonly slain, and their goods plundered. Cursed, cursed be the slaughter of the wounded, and the death of men whose lives should have been held sacred. Hear my warning, the name of Kshatriya has been disgraced." All good men rejoiced as they heard Alhan's stern speech, but it fell as a thunder-bolt on the heart of the king. Says the king Mahil in a rage: "Hear, son of Dasarath, you have spoken bitter words to a king, in

\* 'The king's family.' This I take to be meaning of the word *rāwal*, Prákrit for *rājakula*. Or it may be simply 'you,' as *rararu*.

† 'The bard.' In the original *ráy*, a word which most *bhāts* at the present day take as an affix to their name.

whose power are all things." Alhan turned upon the king Mahil with an angry glare in his eyes; king Parmál smiled, while his nobles grasped their bows. Not without calculation did Alhan reprove the king: fate has had its course, who now can undo it?

The only two Persian words in this passage are *darbár* and *kamán*. They are rather frequent in the earlier part of the canto, which contains the following: *hukm*, *farmán*, *tegh*, *bágh*, *muáf*, *arz*, *tamáshá*.

I cannot conclude this paper without one remark on a subject which I have handled so often, that I fear it has become tedious. I mean the comparative claims of Hindi and Urdu to be considered the vernacular of modern India. When I wrote the above translations, I was in camp at a small town, or rather village, in the Mainpuri district. Finding my way through the text by no means clear, I enquired if there was any Pandit in the place. It appeared that there was none. But in the course of the morning, four shop-keepers from the bazar came in to see me, who said they had a taste for books. The passage was read aloud by one of the number, and I found that all were able to follow the general meaning and, when any difficulty occurred, could offer some suggestion, which, however defective in accuracy of scholarship, was often conducive to the true interpretation. I have thus been enabled to present the translation in a more complete form than would, I believe, have been possible for any single unaided European scholar. Not one of my four friends was a professional Pandit, nor claimed acquaintance with any language beyond his own mother-tongue; and it must further be remembered, that the *Prithiráj-rayasa* is a work of very considerable antiquity. This little incident shews in the very strongest light, that Hindi is still to the present day, and always has been, the real vernacular of modern India, that is to say, the language ordinarily used by the middle classes and best understood by them. Urdu, no doubt, is largely spoken in the North-West Provinces, and has enriched colloquial speech with many words which it would now be pedantry to condemn; but precisely in the same way, English is largely spoken in the neighbourhood of Calcutta, and has had a deep influence in the formation of the modern Bengali idiom. Yet English still remains a foreign language and so does Urdu. I confidently challenge my

kindly critic M. Garcin de Tassy to produce a parallel instance on his side of the question, and shew how, on finding some obscure Persian or Urdu book more than he could manage, he called in two or three chance banyas from the bazar, and received from them a satisfactory solution of his difficulties. Till this has been done, I must hold to my old convictions, and base thereupon a practical theory, *viz.* that popular education should be imparted through the medium of the vernacular Hindi; and, if it is, as I believe it to be, desirable to teach a second language, this foreign language should be not Urdu, the memorial of an obsolete dynasty, but, in accordance with immemorial Indian usage, the language of the dominant power, that is to say at the present time, English.

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*A Vocabulary of the Garo and Konch Dialects, by Lieutenant  
W. J. WILLIAMSON, Assistant Commissioner, Garo Hills.*

<i>English.</i>	<i>Garo.</i>	<i>Konch.</i>
One.	Sá.	Gasak.
Two.	Ginni.	Dúi.
Three.	Githam.	Tín.
Four.	Brí.	Chár.
Five.	Bañá.	Páñch.
Six.	Dok.	Choy.
Seven.	Chhínni.	Sát.
Eight.	Chet.	Át.
Nine.	Síkú.	Nau.
Ten.	Chikiñ.	Das.
Twenty.	Khol.	Korí.
Fifty.	Kholcháñ ginnichhí.	Panchás.
Hundred.	Ríchesá.	Ek Sau.
I.	Añá.	Án.
We.	Chiñá.	Nún,
Thou.	Ná.	Ní.
He.	Bí.	Uá.
They.	Bísáñ.	U'jaruñ.
Of me.	Añní.	Ání.
Of us.	Chiñní.	Núní.
Of thine.	Náñní.	Níní.
Of you.	Náshañní.	Níruñní.
Of him.	Bíní.	U'ání.
Of them.	Bíshoñní.	U'juruñní.
Mine.	Añní.	Ání.
Our.	Chiñní.	Núní.
Thine.	Náñní.	Níní.
Your.	Náoñní.	Níruñní.
His.	Bíní.	U'ání.
Theirs.	Bíshoñní.	U'áruñní.
Hand.	Ják.	Chák.
Foot.	Jáchok.	Játêñ.
Nose.	Giñ.	Nákúñ.
Eye.	Mukruñ.	Múkún.

<i>English.</i>	<i>Garo.</i>	<i>Konch.</i>
Mouth.	Kushik.	Kákham.
Tooth.	Wá.	Phá.
Ear.	Náchil.	Nákál.
Hair.	Khinní.	Khau.
Head.	S'khú.	Dhákam.
Tongue.	Srí.	Theláí.
Belly.	Búkma.	Ok.
Back.	Jánil.	Káñjú.
Iron.	Síl.	Loá.
Gold.	Soná.	Soná.
Silver.	Rúpá.	Rúpá.
Go.	Riáñ.	Leí.
Eat.	Chhá.	Sá.
Sit.	Ásuñ.	Mosúñ.
Father.	Ájá.	Áwá.
Mother.	Ámá.	Áme.
Brother.	Ádá.	Bháí.
Sister.	Áno.	Jánau.
Man.	Mánde.	Mařok.
Woman.	Mechiksa.	Mágjú.
Wife.	Jik.	Jugjú.
Child.	Písá.	Sásá.
Daughter.	Deníchikpísá.	Mágjú sásá.
Slave.	Nokhol.	Ğhúlám.
Cultivator.	Gámnimánde.	Ğrihastímurg.
Shepherd.	Mendá Rákwál.	Bherá Rákwál.
God.	Sáljoñ.	Iřshwor.
Devil.	Muţţí.	Why.
Come.	Rí bá.	Pháy.
Best.	Námbáţţá.	Sabse Penim.
Stand.	Chádeñ.	Kharaţúñ.
Sun.	Sál.	Ráshán.
Moon.	Jájuñ.	Nárek.
Fire.	Wál.	Wář.
Water.	Chhí.	Tí.
House.	Nok.	Nok.

<i>English.</i>	<i>Garo.</i>	<i>Konch.</i>
Horse.	Ghorá.	Ghorá.
Cow.	Máchú.	Máchú.
Dog.	Acháak.	Kwai.
Cat.	Meñúñ.	Meyan.
Cock.	Dho.	Ṭhak.
Duck.	Dhorájá.	Hánsak.
Ass.	Unknown.	Same as Bengali.
Camel.	Ditto.	Ditto.
Bird.	Dho.	Ṭhak.
To die.	Síná.	Ṭhíná.
To give.	Roná.	Lákhau.
Run.	Theñrí.	Thalak.
Up.	Sákhá.	Kára.
Near.	Shefáñ.	Dákán.
Who.	Sá.	Cháñ.
And.	Ara.	Ara.
Yes.	Hoe.	Hán.
Down.	Khámá.	Kámá.
Far.	Chela.	Jánau.
What.	Inhau.	Atáwá.
But.	—	—
No.	Dúnjá.	Erá.
Before.	Skuñ.	Age.
Behind.	Jámán.	Páse.
Why.	Mauna.	Atání.
If.	Bá.	Jađí.
Alas.	Achai.	Hai.
A father.	Afásá.	Awágusuk.
Two fathers.	Afáginni.	Awáduitá.
Of a father.	Afání.	Awání.
Fathers.	Afádhrañ.	Awábren̄.
Of fathers.	Afádhrañni.	Awábréñní.
To a father.	Afákhó.	Awání.
To fathers.	Afádhrañkho.	Awábréñní.
From a father.	Afáníkho.	Awájikiñ.
From fathers.	Afádhrañkho.	Awábréñníjikiñ.

<i>English.</i>	<i>Garo.</i>	<i>Konch.</i>
One daughter.	Demíchikpísá.	Mágjú sásá.
Two daughters.	Demíchikákgiinni.	Mágjú sásá dúíjun.
Daughters.	Demíchikdráñ.	Mágjú sásá gátá.
Of a daughter.	Demíchikní.	Mágjú sásání.
Of daughters.	Demíchikdráñní.	Mágjú sásá gátání.
To a daughter.	Demíchikkho.	Mágjú sásání.
To daughters.	Demíchikdráñkho.	Mágjú sásá gátání.
From a daughter.	Demíchikníkho.	Mágjú sásání jikiñ.
From daughters.	Demíchikdráñníkho.	Mágjú sásá gátáníjikin.
A good man.	Mánde námá.	Murg penim.
Two good men.	Mánde ákguini námá.	Murg dúí jun penim.
Good men.	Mándenámá dhráñ.	Murg penim gátá.
Of a good man.	Námá mándeni.	Murg penim ní.
Of good men.	Námá mánde dhráñní.	Murg penim gátání.
To a good man.	Námá mándekho. [kho.	Murg penim ní.
To good men.	Námá mánde dhráñní-	Murg penim gátání.
From a good man.	Námá mándeníkho.	Murg penim níjikin.
From good men.	Námá mándedráñnikho.	Murg penim níjikin.
A good woman.	Námá míchiksá.	Mágjú penim.
Good women.	Námá míchikdráñ.	Mágjú penim gátá.
A bad boy.	Písá áksá námjá.	Sásá gusuk nágtá.
A bad girl.	Míchikpísá áksá námjá.	Mágjú sásá gusuk nágtá
Good.	Nama.	Penim.
Better.	"	"
Best.	"	"

Comparison formed thus,—

A good man.	Námá mánde.	Murg penim.
A better man.	Indibá námá mánde.	Iyání cháý íá penim murg.
The best man.	Indibánámbáttá mánde.	Sab se íá penim murg.
High.	Chúá.	Chúá.
Higher.	Indibá chúá.	Iyání cháý íá chúá.
Highest.	Indiba chúbátá.	Sab se íá chúá.
A horse.	Ghorá mañsá.	Ghorá gusuk.
One bull.	Máchúbíjá mañsá.	Dámrá gusuk.
A dog.	Acháak mañsá.	Kwai gusuk.

<i>English.</i>	<i>Garo.</i>	<i>Konch.</i>
One male goat.	Dobok bíjá máñsá.	Púrún pántá gusuk.
A male deer.	Máchuk bíjá.	Máchuk pántá.
A mare.	Ghorá bímá.	Ghorá mágjú.
A cow.	Máchú bímá.	Máchú gái.
A bitch.	Áchák bímá.	Kwái mágjú, <i>or</i> kwai júburá.
A she-goat.	Dobok bímá.	Púrrún pántí.
A female deer.	Máchuk bímá.	Máchuk pántí.
Horses.	Ghorá dhráñ.	Ghorá gátá.
Bulls.	Máchúbíjá dhráñ.	Máchú bullud gátá.
Dogs.	Áchák dhráñ.	Kwái gátá.
Bitches.	Áchák bímá dhráñ.	Kwái mágjú gátá.
Goats.	Dobok dhráñ.	Púrún gátá.
Deer.	Máchuk dhráñ.	Máchuk gátá.
I am.	Añá hoñ.	Án doñná.
Thou art.	Ná hoñ.	Ní doñ.
He is.	Biyá hoñ.	Uá doñ.
We are.	Chiná hoñ.	Nún doñná.
You are.	Náshoñ hoñ.	Níruñ doñ.
They are.	Bíshoñ hoñ.	Ujáruñ doñ.
I was.	Añá duñá muñ.	Án ʈoñbá.
Thou wast.	Na duñá muñ.	Ní ʈoñbá.
He was.	Biyá duñá muñ.	Uá ʈoñbá.
We were.	Chiná duñá muñ.	Nuñ ʈoñbá.
You were.	Náshoñ duñá muñ.	Níruñ ʈoñbá.
They were.	Bíshoñ duñá muñ.	Jíruñ ʈoñbá.
Be.	Hoñá.	Doñá.
To be.	Hoñá.	Doñá.
Being.	Hoñe.	Doñe.
Having been.	Hoñímúñ.	Doñímoñ.
I may be.	Añá hoñá mánúá.	Án doñ máná.
I shall be.	Añá hoñua.	Áñ doñá.
Beat.	ʈok.	ʈok.
To beat.	ʈokná.	ʈokní.
Beating.	ʈoke.	ʈoke.
Having beaten.	ʈoke muñ.	ʈokemuñ.

<i>English.</i>	<i>Garo.</i>	<i>Konch.</i>
I am beating.	Aña dokúñá.	Án ɬoktú.
Thou beatest.	Ná dokúñá.	Ní ɬoktú.
He beats.	Bíyá dokúñá.	Uá ɬoktú.
We are beating.	Chiñá dokúñá.	Nún ɬoktú.
You are beating.	Náshoñ dokúñá.	Nirún ɬoktú.
They are beating.	Bíshoñ dokúñá.	Ujárún ɬoktú.
I beat.	Aña dokná.	Án ɬokná.
I was beating.	Aña dokúñamúñ.	Án ɬokuñbá.
I had beaten.	Aña dokámuñ.	Án ɬokbámuñ.
I may beat.	Aña doknábádúñá.	Án ɬokníbátoá.
I shall beat.	Aña doknúá.	Án ɬokná.
I should beat.	Aña doknámuñ.	Án toknámuñ.
I am beaten.	Aña doká mañchájok.	Án ɬok másásí.
I was beaten.	Aña dok máñchábájok.	Án ɬok másápaisí.
I shall be beaten.	Aña dok máñchánúá.	Án ɬok másánúá.
I go.	Aña ríáñna.	Án lainá.
Thou goest.	Ná rúíñá.	Ní laiɬú.
He goes.	Bíyá ríuñá.	Uá laiɬú.
I went.	Aña ríáñjok.	Áñ laisi.
Thou wentest.	Ná ríáñjok.	Ní laisi.
He went.	Bíyá ríáñjok.	Uá laisi.
Go.	Ríáñ.	Lai.
Going.	Ríáñá.	Lainíyai.
Gone.	Ríáñe.	Laimúñ.
What is your name?	Náñí mai Bímún?	Níní áɬá múñ?
How old is the horse?	Iá ghoṛá básik bilsí sání?	I ghoṛa koy bossorñi.
How far is it from here to Cashmir?	Káshmir básik shelá?	Káshmir bísín jánú?
How many sons are there in your father's house?	Náñfáñí noko básik písá mánde áksá?	Níní áwání nokai koy jon sásá murg?
I have walked a long way to-day.	Dál áñá chelásání rúa- mí ribajok.	Tíní án pánai dúrní jí- kín lájum paisi.
The son of my uncle is married to her sister.	Añí áúñní písá uá mí- chíksání áñákho jik doñjok.	Áñí úántíní sásáwá í mágjúni jánau joní biyá ráksi.

<i>English.</i>	<i>Garo.</i>	<i>Konch.</i>
In the house is the saddle of the white horse.	Nokniñá ghorá ní júi dúñá.	Nok bhítüre ghure bok- níyáni jín toá.
Put the saddle on his back.	Bíní jáñilá jín gátbo.	U'áni kúnjúai jín lákha.
I have beaten his son with many stripes.	Bíná písáko áñá bañe ñoketá.	U'áni sásáwau áñ pañai ñoká suksí.
He is grazing the cat-tle on the top of the hill.	Hádeñ sákau mogá ñuñá.	máchú Hákau káráwáy machu dáñatú.
He is sitting on a horse under that tree.	U'á bol Jáfáñ ásañe dúñá.	ghorau U'á páñchúñai ghorau wai másuñáy ñantú.
His brother is taller than his sister.	Bíní ádá bíní ábí nábá dhálá.	gúpá- U'áni bhái u'áni níbá mátá.
The price of that is two rupees and a half.	U'áni dám gonsá ádullí.	U'áni dám dúi ñáká ek ádullí.
My father lives in that small house.	Hai U'á nok añní áfá duñá.	chonau U'á nok puláwe ání áwá ñoñá.
Give this rupee to him.	I dáñá bíko ron.	I ñáká u'áni lákha.
Take those rupees from him.	I dáñá bichá rábhá.	I ñáká u'áni lá.
Beat him well and bind him with ropes.	Biko náme dokbo bágáchá khá donbo.	ára Iyáni khúb ñok ára khú- rúgátí khaiñan.
Draw water from the well.	Khúa níkho chí khobo.	Khúaní tiká khoñ.
Walk before me.	Añnískuñ rí.	Aní áge le.
Whose boy comes behind you?	Sání písá nání ribá uñá?	jámánú Chání sásá níni páse paítú?
From whom did you buy that?	U'áko sáníkho brírá?	U'au chání gátai purlá- táné?
From a shop-keeper of the village.	Shoñní dúkándár rá.	Gáñwní dúkándár níyai púrlátánai.

*Text and Translation of Balandshahar Inscription. By*

PRATA'PACHANDRA GHOSHA, B. A.

[Received 13th March, 1869.]

The copper-plate inscription, a translation of which is hereto appended, was presented to the Society in February, 1867 by Mr. Webster, Collector of Balandshahar. He says, it was found in a ruined gurhee situated in mouzah Manpur, pergunna Agoutha. The inscription records the grant of a village named *Gandavá*, made by one *Ananga* to a brahman of the *Vátsa Gotra*. The grant was made in the vernal equinox of Samvat 1233. The engravers were *káyasthas*.

The plate is in tolerable preservation, and measures 1 foot 9 inches by 1 foot 1 inch. It would have been a useful link in the chain of Indian history of the time of the first Mahomedan invasion, if some coins or other inscriptions were forthcoming as corroborations of the dates and the names of kings immortalized in this plate. But as it is, the plate is a solitary landmark in the history of *Kalinga*, a name that conveys to the mind of the reader a vague notion of the sea-coast on the south of Bengal. The most inexplicable fact connected with this plate is, that it was found so high up near Balandshahar.

Kalinga has no representative in the coin cabinet, unless under some other name; and the names of the kings Govinda, Chandraka, Bhojadeva, Vikramáditya and Ananga, though occurring in many dynasties, are never coupled with the Kalinga country or the Rodra family, a family quite unknown in the history of the Deccan. Kalinga extended over a large tract of country from Orissa to the Nilgiris. It was never owned by a single sovereign. Different parts of it were at the same time owned by several potentates, and the Rodra dynasty was one of those petty chiefs. The kings of Orissa, for a long time in the tenth, eleventh, twelfth, and thirteenth centuries, called themselves sovereigns of Kalinga and Karnáta (*Kalinga nava koti Karnate-svara*), though it is known, they had little to do with Karnáta, which had its own kings. Such assumptions of sovereignty over dominions which kings do not possess, are not rare. Rodras probably owning a small part of Kalinga, assumed the whole.

This race of kings is quite unknown, unless the reading of the name is found fault with; and I admit, it may be read otherwise.

The reading of the letters कनिष्टो is very dubious, and it is painful to observe that the two principal names (of the place and of the family) which make the record important, are uncertain; so is also the date, the plate at that part being partly destroyed by time, and two letters are missing. The name of the family which was at first read as Rodra, on second thought appears to be something different. It is most like *Yodu*; but the final *t* (त) of the previous verb आसीत् being combined with it, as it is in the inscription, would not appear so. It is spelt as if it were *djo* (द्व), the final *t* (त्) being changed into *d* (द), and *j* (ज), as a matter of course, goes under it. The simple rules of Sandhi must, however, change the final *t* (त्) into *j* (ज), and not into *d* (द) as it appears. On the other hand again, the word *Yodu* does not begin with a (ज) *j*, but a (य) *y*. The reading then is evidently something else. Does the word डोद्र stand for the Rahtor dynasty, a family that ruled at Kanouj, and one of whose princes Govindachandra reigned at about the time of the inscription, and whose name appears in the Fyzabad inscription (J. A. S. B., vol X. p. 98) and also on coins?

The letters which were construed to be the name of the country Kalinga are very ambiguous and illegible. But considering the rude stage of the art of engraving, the much ruder instruments then in use, and the ignorance of the engravers, it may be safely assumed that the न there stands for ल and as the compound letters are not distinctly written, the डो may be said to represent डो. Thus we have the name of Kalinga. With the other reading of *Kanishṭha* (कनिष्टो) however the passage explains itself equally well. The passage translated reads thus with *Kalinga*.

‘Then from the sacrifices of the virtuous king of Kalinga, was born Ananga, the chief of kings, full of prowess, and splendour.’ With *Kanishṭha*, however, it reads as follows:—

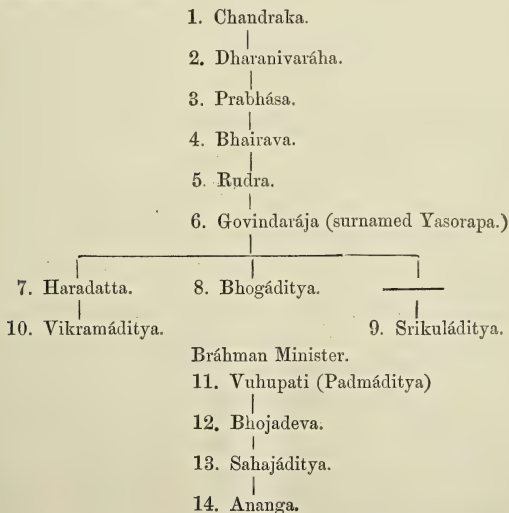
‘Then from him was born Ananga, the chief of kings, full of prowess and splendour, (as well becomes) the younger brother of (Yudishṭhira) Dharmarāja.’

In the former reading, we have to supply an अ ि to आहव, while for the second we have to assume a comparison. In either case, however, to give sense, the अ ि after जान must be changed to ॆ.

The grant records the names of princes of two distinct families,

though they are all grouped under the same family name. The record goes backwards to the fourteenth crowned head from the donor. It begins with Chandraka who, it appears, must have been either the founder of the family, or was distinguished for some meritorious act. If the family name be Rahtor, Chandraka must have transferred the seat of government from Kanouj, and established himself in the new city. The seventh linear descendant from Chandraka is Haradatta, whose brother Bhogáditya or Homáditya succeeded him. The name of this prince again is not clear, it may be read Bhogáditya or Homáditya. His nephew Sri-kuláditya followed him to the throne. After him, came Vikramáditya, the son of Haradatta. The last named prince was dethroned, it appears by his brahman minister, Vuhupati who, on ascending the throne assumed the more royal name of Padmáditya. Padmáditya is the founder of a line, and the fourth from him is Ananga, the donor of the village.

The names stand thus :



The inscription is in modern Sanscrit, and the characters belong to the period immediately succeeding that of the Kutila inscriptions

of the tenth century. The date assigned to the inscription is conjectural, as the plate at that part is defaced by rust. The words clearly recognizable are चयत्रिंशद्दिक.....शतानि, the space intervening is just sufficient for three letters.

The faint impression of the first is something like द्वा, but the last traceable is a ख. The intermediate has evidently a *repha* on it. The combination would evidently be द्वादश, which may be interpreted as a misspelling of द्वादश. The interchange of श and स is not unprecedented with the scribes and engravers of this plate. The very first couplet of the inscription has a similar error, सुरेशय is spelt with a dental स at the end. There are many such errors; in some passages the final á has taken the place of a *visarga*, the two dots of which when joined, resemble the á. The inscription uses three different forms of the palatal s, and the distinction of the dental न न and dental त त is not at all preserved. The Kutila forms of *bha*, *ha*, *dha*, *ga*, and cerebral *na*, are perfectly preserved in the characters of the inscription, though the compound of the cerebral न ए with य य is like that of the modern Nágrī ए. The form ल्य, however, appears once for *nya*. At some places, the dental स स is of the modern form, and at others as old as that of the Vallabhi plate of Gujrat. *Bha* is of the Allahabad Gupta form. The initial *i* and *e* are of a very old type, and it is curious to observe how characters of very different antiquity are promiscuously used.

The language of the inscription is not at all pure and chaste. Grammatical errors, especially misapplications of case-terminations, are common. It is interesting to note that the inscription begins with a descriptive character, the personages are described in the third person; but as it comes to the close, the method of reported speech is discontinued. The writer confounds the sayings of the kings with his own, and it is very difficult to render the passages. This is mainly due to the want of the signs of quotation in Sanscrit Grammar. The language is very like that of many other grants by similar petty chiefs. The last five lines are identical with those of Válavarmá Deva, Virasningha Deva and Pratápadhavata Deva. (Compare A. R. vol. IX. p. 402, J. Am. O. Soc., vol. VI. pp. 538-548.)

## TRANSLATION.

1. Om. Salutation to Kásivisvesvara. Salutation be to the God of gods (Siva), to the donor of all that is desirable, to him, by whose eight forms the three worlds are enveloped.

2. Praise be to moon-like Sarasvati, the fountain of nectar and the destroyer of darkness of previous (life), beautifier (as a lotus) of the ocean of eloquence.

3. Those brahmans bless, from whom, even earth (land) given with devotion waits on the donor in the forms of gold and jewels.

4. Donations destroy sin and afford victory in this world. The donor is sufficiently blessed by gifts and donations to them (brahmans). Vipras purify the sin of their donor and the good solely engaged in their (brahmans') worship are blessed.

5. There was a king named *Chandraka*, renowned chief of the Rodra family. His son was *Dharanivaráha* and his (son) was named *Prabhása*.

6. From him was a king named *Bhairava*, and from him again, was king *Rudra*, fierce as the *Rudra*. Next, his son *Govindaraj* (surnamed) the Yasorapa of irresistible will, became king.

7. His son named *Haradatta* became king. Then was born *Tribhuvanáditya* by whose own mountain-like body the immersed earth was recovered.

8. His younger brother Srimán *Bhogáditya* succeeded him a king, seeing whom men believed the day was two sighted. *Srikuládityadeva* powerful as night, son of his younger brother came on next.

9. Haradatta's son on coming to age assumed the name of *Vikramaditya*. He was unequally virtuous. His brahman minister Sriman *Vuhupati* more wonderful than he, ascended the throne, under the name of Padmaditya, the celebrated lord of the world and *kalpatree* of all riches. The irregular and formidable will of time was gained, and before illness (death) came on, his unblemished glory, more illustrious than the autumnal moon, the jasmine and the lily, was published.

10. From him was born the ruler of the earth named *Bhojadeva*, profound in war and the most valorous of heroes in the field of battle. After him reigned *Sahajáditya* the king of kings, whose governor of the liquor of riches was Ranavir as wise as Kesava; by whom (*Sahajaditya*) the sunken earth was rescued from the ocean and

cherished, as it was raised by the tortoise (incarnation) and scorched by whose power (his) enemies could not prosper.

11. From him was *Ananga*, the chief of kings, full of prowess and splendour, (as well becomes) the younger brother of (Yudishtira Dharmarāja.) He learnt from great rishis (that) the presentation of land is the best of all gifts. Having been convinced that this gift is the best of all, he searched for a proper donee.

12. There is *Palhala*, a brahmana of the *Gouda* family, son of Vishnu and grandson of *Sadhala*, of Vatsa gotra and of five pravaras, kulin, the foremost of the meritorious. Being acquainted with this donee, the lotus-eyed monarch granted the village of Gandva to him at the time of the equinox and at a fortunate moment seated with his face towards the east. This village, properly hedged by long prescription, is to be enjoyed by him as long as the moon, the stars and the sun shine.

13. To the future kings of this family, having made my palms folded under my forehead, and having placed the two hands together, I say, do not reverse this *Sāsana*.

14. Many lands were given by Sagara and other kings, but his is the plough who owns the lands. He who encroaches the land given by himself or others, becomes a beast so long as unnatural events do not happen.

15. He who receives lands and he who gives them away, both performers of pious deeds, always go to paradise.

Written by *Gadejaka*, grandson of *Bijana*, a káyastha of the Māthura family, and *Videsvara*, son of *Sridhara* of the Jāgar family. Inscribed by our graver in Samvat 1233, Vaisākha.

Transcription of the Inscription in Devanāgarī.

ॐ काशीविश्वेश्वराय नमः । नमस्तस्मै सुरेशाय सर्वकामप्रदायिने ।  
येनेदं त्रिजगद्वाप्तमष्टाभिर्निजमूर्तिभिः ॥ पौर्वान्धकारशमनी वाम-  
याव्येर्विकाशिनी । जयत्वमृतसंभूतिश्चन्द्रमूर्तिः सरस्वती ॥ जयन्ति ते  
द्विजायेभ्यो दत्ता मृदपि भक्तितः । स्वर्णरत्नादिरूपेण दातारमुपतिष्ठ-  
ते ॥ दानानि कल्मषहराणि जयेति लोके । तेभ्योपि दानप्रदानैर्जयति  
प्रकामं ॥ तत्पात्रपस्य तमसश्च जयन्ति विप्रस्त्यूजनैकनिरताश्च जय-  
न्ति सन्तः ॥ आसीद्देद्रकुलप्रकाशतिलकचन्द्रकनामा नृपस्तत्सुतो ध-

रणीवराह उदभूतस्य प्रभासाभिधः ॥ तस्माद्भैरव इत्यभून्नरपतिस्त-  
 स्माच्च रुद्रोपमो । रुद्रो नाम नराधिपेस्य च सुतो गोविन्दराजोऽभव-  
 न्तस्य यशोपर नामा दुर्द्धरकामाभवन्नराधिपतिः । हरदत्तनामधेय  
 तस्य च तनयो वभूवन्नृपः ॥ ततस्त्रिभुवनादित्यो भवन्निह महोदधौ ।  
 मन्नाभू उद्धृता येन वराहवपुषा स्वयं ॥ तदनु तदनुजः श्रीमान्हेमा  
 दित्योभवन्नराधिपतिः । यं दृष्ट्वा द्वितयनमेव वासरं मेनिरे लोकाः ॥  
 तदनु दनुतनुजः रात्रितुल्यप्रावभः समभवदवतीर्णः श्रीकुलादित्य-  
 देवः ॥ अथ भुवि हरदत्तस्यात्मजो प्यायकोभून्नृपतिरतुलधर्मा वि-  
 क्रमादित्यनामा ॥ तस्माद्विस्मयतीव विप्रसर्चिवः श्रीमान् भुञ्जतिः ।  
 पद्मादिय इति क्षितीशतिलकः सर्व्वर्द्धिकल्पद्रुमः ॥ कालाकालकराल-  
 कान्तिकलिताद्यभवद्गदशाग्रतो जातं शारदचन्द्रकुन्दकुमुदै र्योताव-  
 दातयशः ॥ तस्माद्वभूव भूपालो भोजदेवेति विश्रुतः । संग्रामाङ्गणवीर-  
 स्य निगूढं सौर्यमुत्तमं ॥ ततः श्रीतहजादित्यराजराजेति शब्दितः ।  
 रंवीरो यस्य नेताभूत्वाश्वस्येव केशवः ॥ खरात् समुद्धृता येन मग्नं स-  
 न्तुमहोदधौ । जुञ्जमाना पुरा पृथ्वी कूर्मैर्गैवाद्धृता यथा । यस्य प्रताप-  
 निर्दग्धा न प्ररोहन्ति शूचवः ॥ ततस्तस्याहवाज्जातो अनङ्गो नृपनाय-  
 कः । सौर्यवीर्येण सम्पन्न कलिङ्गो धर्मभूपतेः ॥ स सुश्राव महर्षिण्य-  
 सर्वदानोत्तमभुवः । दानं श्रेष्ठमिति ज्ञात्वा ततः पात्रमचिन्तयत् ॥  
 अस्ति गौडान्वये विप्रो विष्णु पुत्रोहि पल्लव । पौत्रो साठलविप्रस्य  
 वत्सगोत्रस्य सम्भवः ॥ पञ्च प्रवरसंयुक्तो कुलीनोहि गुणायणीः ॥ एनं  
 पात्रमिति ज्ञात्वा राजा राजीवलोचनः । अमुष्मै प्रदद्यामं गण्डवा नाम  
 संज्ञिकं ॥ संक्रान्तौ विधुवे काले शुभक्षणे प्राक्दिकस्थितः । ग्रामोयं प्रा-  
 चीनक्रमेण संजातसीमयोपेतः ॥ आचन्द्रतारकार्कसाहिजनेन त्वया भो-  
 ग्यः ॥ किञ्च येस्मिन्वंशे भाविनो भूमिपालाः । कृत्वा मौलाधञ्जलि प्रक्षिप्ये  
 ताह ॥ तस्याहङ्करलभ्योपि शासनं न व्यतिक्रमेत् । वज्रभिर्वसुधा दत्ता  
 राजन्यैः सगरादिभिः । यस्य यस्य यदा भूमी तस्य तस्य तदाहलं ॥ स्व-  
 दत्तां परदत्तां वा यो हरेत् वसुन्धरां । स तिर्यक्त्वमवाप्नोति यावदाहृत-  
 संभव ॥ भूमिं यः प्रतिगृह्णाति यः स भूमिं प्रयच्छति । उभौ तौ पूण्य-  
 कर्माणौ नियतौ स्वर्गगामिनौ ॥ लिखत कायस्य मायुरान्वयबीजनपौत्र  
 गदेजकेन तथा जागरान्वय श्रीधरात्मजेन विद्येश्वरेण ॥ अवयोः सवि-  
 ण्या वरिचितमिदम् ॥ संवत्त्रयत्रिंशदधिकद्वादश शतानि ॥ वैशाखे च ॥



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*On the History of the Burma race. By Colonel SIR ARTHUR PHAYRE,  
K. C. S. I., C. B., Bengal Staff Corps.*

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In a former paper on the history of the Burma race, it has been stated that the Mahá-Rá-dzá-weng relates that king Kyau-tswá, youngest son of Na-ra-thí-ha-pa-té who reigned at Pu-gán, was dethroned and eventually murdered by three brothers of Shán race in the year 660, being 1268 A. D.\*

The story of these three brothers is thus related: In the reign of Na-ra-thí-ha-pa té, surnamed Ta-ruk-pyé-meng, the Tsau-bwá or Chief of Bhein-na-khá, a small Shan state, died, leaving two sons. They quarrelled regarding their inheritance, and the younger, named Theing-kha-bo fled into Burma, where he settled at Myin-tsaing, some thirty miles south of the present city of Ava. For many years an immigration of the Shán or T'hai race had been going on into the valley of the Iráwati. They had established an independent kingdom in the upper portion of the country, and about the beginning of the thirteenth century of the Christian era, had poured into

\* There is, as has before been mentioned, a discrepancy of seven years between this date, and that obtained by the total number of years of the reigns of the kings of Pugán, ending with that of Kyau-tswá. I have, however, considered it better to accept the year given in the text of the Mahá-Rá-dzá-weng, namely 660 of the Burmese era (= 1298 A. D.) as the year when the three Shan brothers commenced to reign.

Assam. During that period also, they had, by their numbers and their superior energy, gradually acquired considerable influence within the kingdom of Burma. The young Shán Prince, therefore, in coming to Burma, probably settled where a colony of his own race already existed. He married, and had three sons and a daughter. The sons were named A-theng-kha-yá, Rá-dzá-theng-gyan, and Thí-ha-thú. His daughter's name is not mentioned. Theing-kha-bo so managed that his three sons were taken into the royal service, and they became great favourites with the king. After the death of Ta-ruk-pyé-meng, his son and successor Kyau-tswá also favoured the Shán youths. The eldest A-theng-kha-yá received the district of Myin-tsaing as governor thereof; Rá-dzá-theng-gyan received Mek-kha-rá; and Thí-ha-thú received Peng-lay. The three brothers became rich and powerful. Their sister, whose name is not given, was married to Prince Thi-ha-thú, the second son of Ta-ruk-pyé-meng, who was accidentally killed in Pegu.

The three Shán brothers after having deposed and murdered king Kyau-tswá, lived at Myin-tsaing in royal state, and governed each his own province. The elder alone had a royal palace denoting his superior position. Queen Tsau, the widow of Na-ra-thí-ha-pa-té, who had suggested the conspiracy against Kyau-tswá, her step-son, retired to Pu-gán. The eldest son of Kyau-tswá, named Tsau-nhit was allowed to live in the ancient palace at Pu-gán, with the title of king. A younger son, Meng-Sheng-tsau, was made governor of the district of Tha-ret.\*

At this time the whole of the Shán states, east of the Iráwati, were independent, as also were Mogoung, Mo-nhyin, Ka-lé, and other states, west of the river. The three brothers who now represented the ancient Burmese monarchy, had authority along the course of the river Iráwati as far south as Tha-ret. It is doubtful whether they held authority in Tounghú. The descendant of the ancient kings, Tsau-nhit, was allowed to live quietly at Pugán, where he died in the year 687. And it may be mentioned here, that his son Tsau-mwonnit was also allowed to live quietly at Pugán. He died in the year 730 (A. D. 1368) being the last of the Pugán dynasty.

In the meantime the three Shán brothers with their capital at

\* This statement will be noticed subsequently.

Myin-tsaing ruled over what territory remained of the Burmese kingdom. The youngest brother Thí-ha-thú, surnamed Ta-tsí-sheng, who was destined to transmit the throne to his posterity, at least during half a century, married a queen of the deceased Kyau-tswa, named Meng-tsau-ú, and called in history Bwá-Tsau. Five years after the brothers had established their power, the second brother Rá-dzá-theng-gyan died. Some years later or in 672, Thi-ha-thú poisoned his elder brother A-theng-kha-yá, and then succeeded to the sole power.

In the year 671, Thí-ha-thú had searched for a suitable position on which to build a new city. He selected that upon which the city of A-wa or Ava, was afterwards built. But supernatural obstacles prevented the work from being accomplished. Being then guided towards the south, in digging for the foundation of a pagoda, a golden plant in flower was discovered. The king was then convinced that this was a fortunate spot whereon to build a city. The city was therefore built in the year 674 (A. D. 1312), and called Pán-ya from the golden flower having been there obtained. The name was gradually changed into Peng-ya. The city was also called Wi-za-ya-pú-ra.

King Thí-ha-thú Ta-tsí-sheng was now publicly married to Queen Bwá-tsau, widow of king Kyau-tswá. She was a daughter of Ta-ruk-pyé-meng by one of the inferior Queens, and consequently half sister to Kyau-tswá. She resided at Pugán. On her arrival at Pán-ya, she performed with the king the usual royal ceremonies of formal entrance into the palace, enthronement beneath the umbrella, and solemn pouring out of water. The palace life was now ordered in every thing according to the ancient customs of the kings of Pugán. The son of the Queen by the late king Kyau-tswa, named Ū-za-ná, was adopted by Thí-ha-thú, and declared Ein-shé-meng or Crown-Prince. The sons born to Thí-ha-thú by Queen Bwá Tsau were Kyau-tswá and Nau-ra-htá. To complete the king's happiness and confirm his royal title, if that were necessary, a white elephant was captured in the forests and brought to the city. From this event the king assumed the title of Ta-tsí-sheng. He married a second Queen, or now gave high rank to his previous wife. She was of Shán race. She had given birth to a son, A-theng-kha-yá (30

called after his paternal uncle) and named also Nga-ywom-ngai and Tsau-ywon; also to a daughter Tsau-pú-lai. This daughter was married to Pweng-hlá-ú, who was made governor of Toung-dweng, and who probably belonged to the ancient royal race.

The king notwithstanding the precautions he had taken, became alarmed at the supposed designs of his sons by his two chief Queens. The two elder princes, the Crown Prince and A-theng-kha-yá, kept large bodies of armed men in the provinces they governed. A-theng-kha-yá at length received, either apparently or really, against the wish of his father, the province of Tsa-gaing. Immediately after taking possession, he declared himself independent, with a large tract of country under him to the northward. This is said to have been accomplished about the year 677 (A. D. 1315). King Thí-ha-thú Ta-tsi-sheng reigned altogether fourteen years, ten of which were passed at his own city Pán-ya. The historian thus sums up the character of this king: "He was very sagacious. He loved his sons, and behaved so as not to offend any of them. Towards other countries he behaved as one would, if placed over a hot fire. To his own subjects as to a cool jar of water placed in one's embrace." He died in the year 684.

Thí-ha-thú Ta-tsi-sheng was succeeded by his adopted son U-za-ná, son, as has already been stated, to the deposed king Kyau-tswá. U-za-ná's half brother Kyau-tswá, offspring of the marriage of his mother Bwá-Tsau with king Thí-ha-thú, after a time began to intrigue against him, and acquired great influence. He is said to have possessed five white elephants, which is considered a sure sign of rightful kingly power. U-za-ná, however, reigned for twenty years and then announced his wish to devote himself to religion. He abdicated the throne by going out from the palace by the western gate, while his half brother Kyau-tswá entered by the eastern gate. U-za-ná retired to a monastery, and afterwards became a hermit in a forest of the province of Mek-kha-ra.

Kyau-tswá who took the name of Ngá-tsi-sheng, from the five white elephants he owned, ascended the throne in the year 704. Jealous of the independent kingdom established by his half brother A-theng-kha-yá Tsau-ywon at Tsa-gaing, he, before coming to the throne, had tried to have him assassinated. The plan, however, failed,

and during his reign, he does not appear to have been strong enough to interfere with the dynasty of his relations at Tsa-gaing. This king reigned only eight years.

He was succeeded by his son, also named Kyau-tswá, who ascended the throne in the year 712. This king married a daughter of the governor of Tha-ret, called Tha-ret-meng-sheng-tsau, who was said to be a son of the deposed king of Pu-gán, Kyau-tswá. This king desired to be on terms of friendship with his cousin the king who reigned at Tsa-gaing. He married a daughter of that king. He reigned nine years. His brother Na-ra-thú then ascended the throne. After he had reigned five years, Pán-ya was attacked by the Man Shans, and the king was taken prisoner. By this name is meant the Shans of the kingdom of Pong, of which the city of Mo-goung, in the valley of the upper Iráwati, was the capital. This city was called by the Shans Mong-mao-rong. King Na-ra-thú, from having been captured, is called Mau-pá Na-ra-thú. The Shans appear at once to have retreated with their prisoner, and with three white elephants, which probably formed the great object of their expedition. After his capture, an elder brother, probably a half brother by a concubine, was placed on the throne with the title of Uzaná Byoung. But after three months the city of Pán-ya was taken by a Prince called Thado-meng-bya, who became supreme and founded the city of Ava.

These events have brought the history of the kings of Myin-tsaing and Pán-ya down to the year 726 of the Burmese era. The Ma-há-Rá-dzá-weng then relates the history of the line of Princes who reigned at Tsa-gaing, and who were contemporary with those who reigned at the other two cities. It was this branch which brought about a new revolution.

It has already been seen that a son of king Thí-ha-thú Ta-tsí-sheng by a Shan mother, made himself independent, and reigned at Tsa-gaing under the title A-theng-kha-yá Tsau-ywon. This was in the year 677 = A. D. 1315. He died after a reign of seven years, and though he left three sons and a daughter, he was succeeded by his half brother Ta-ra-bya-gyí. After Ta-ra-bya-gyí had been fourteen years on the throne, his son Shivé-doung-tet rebelled, and in the year 698, dethroned his father. On this, the widow of king A-theng-kha-yá Tsau-ywon fled with her children. The family con-

sisted of three sons, and a daughter named Tso-meng, who was married to a young man of uncertain lineage, called Tha-do-tsheng-htien. The family concealed themselves for some time in the hills of Meng-dun. They were, however, captured and brought to the city. But a party was raised against the usurper, and he was killed by a Shan attendant, after a reign of three years. The nobles were unwilling to restore Ta-ra-bya-gyí, and he was put to death. This opened the way to the family of A-theng-kha-ya Tsau-ywon. The eldest son named Kya-tswá was raised to the throne in the year 701. He reigned ten years, and was succeeded by his brother Nau-ra-bta Meng-rai. This king reigned only seven months. The youngest brother Ta-ra-bya-ngai then became king, but died after a reign of three years.

The sister of these three brothers, now entitled Tso-meng-ko-dau-gyí, still remained. She had formerly, as already mentioned, been married to Tha-do-tsheng-htien, now for the first time declared to be of the race of the ancient kings of Ta-goung. He had died, but by that marriage Tso-meng-ko-dau-gyí had a son named Ká-hú-lá, and two daughters, Sheng-tsau-gyí, and Tsau-úm-má. The mother now married Meng-byouk. He was not of royal race, but in right of his wife he was raised to the throne, and took the title of Thí-ha-pa-té. As the young Prince Rá-hú-lá was, (believed to be) through his father, descended from the ancient Burmese royal race of Ta-goung, he was sent to govern that province, which was subject to Tsa-gaing. He was then sixteen years of age, and assumed the name of Tha-do-meng-bya. After some years, he was attacked in his government by a Shan force from Mogoung under a chief, called Tho-khyin-bwá. This attack was made at the instigation of Na-ra-thú, the king of Pán-ya. Tagoung was taken, and Tha-do-meng-bya with difficulty escaped, and fled to Tsa-gaing. There his step-father Meng-byouk Thí-ha-pa-té, enraged at the loss of Tagoung, put him in irons. The Mogoung Shans advanced in great force and attacked Tsa-gaing. The king was obliged to abandon the city, and retired by boat to Kya-khát-wa-rá on the Iráwati. The Shan general saying that king Na-ra-thú had given him no assistance in the war, now attacked and took the city of Pán-ya, which he plundered. He also took Na-ra-thú prisoner. The Shans then retreated.

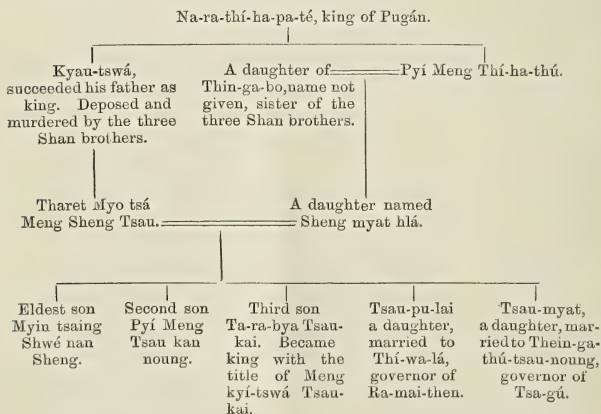
When Meng-byouk, king of Tsa-gaing, abandoned that city, and

fled to Kya-khát-wa-rá, the people who accompanied him, were much discontented. Tha-do-meng-bya found many adherents, and put his step-father to death. He then determined to take possession of the cities, which had been plundered and abandoned by the Mogoung Shans. He first advanced to Pán-ya. There he found U-za-ná Byoung raised to the vacant throne; but he put him to death, and declared himself king of Pán-ya and Tsa-gaing. He, following the custom of the ancient race, married his sister Tsau-úm-ma, who had been Queen to Kyau-tswá, Na-ra-thú, and U-za-na Byoung, the three last kings of Pán-ya. This event occurred in the year 726 = A. D. 1364.

Tha-do-meng-bya had now no rival to oppose him. He determined to build a new city, and in the same year, that Pán-ya and Tsagaing were destroyed, the city of Awa, Eng-wa, or A-va, was built. The Pali, or sacred name, of it was Ra-ta-na-pú-ra (city of gems). The position on the left bank of the I-rá-wa-ti, a little below the mouth of the stream, called Myit-ngé, had long before been predicted by Gau-da-ma as destined to be the site of a great city. Dreams and omens now confirmed the ancient prediction. The work of founding the city was carried on with a degree of energy, prompted by the conviction of the great destinies which were thereby to be accomplished. Lakes and swamps were dammed and drained. Pagodas were built, and the city wall marked out. The king's palace was raised in the centre, and was the citadel of the whole work. Tha-do-meng-bya now ruled over the country all round Ava, Tsa-gaing, and Pán-ya. Toung-ú also is said to have been subject to him. The cities of Nga-nway-gún, Toung-dweng-gyí, and Tsa-gú, were independent. The king first proceeded to reduce Tsa-gú. On the way, he stopped at Pu-gán, and there received the homage of Tsau-mwon-nit, the last nominal king of the Pu-gán dynasty. He was unable to reduce Tsa-gú, which held out under the governor Thein-ga-thú. In the following year, he took Toung-dweng-gyí; and in the year 729, he again marched against Tsa-gú. The chief made an obstinate resistance, and during the siege, Tha-do-meng-bya caught the small-pox. He set out to return to Ava, but feeling that he must die, sent on a confidential servant or minister, named Nga-nú, with orders to put his queen Tsau-úm-ma to death, so that she

might not fall to his successor in the throne. He died soon after, having reigned seven months in Pán-ya and three years in Ava. The history denounces him as a man of savage and cruel disposition, who altogether disregarded religion. He left no children.

The servant of Tha-do-meng-bya having reached the palace, told queen Tsau-úm-ma the order he had received. She turned him from his purpose, and offered him the government of Tsa-gaing. This he accepted, and after a time crossed the river to take possession. There being no direct heir to the throne, the nobles offered it to Thí-la-wá, the governor of Ra-mai-then. But he refused, and at length they chose his brother-in-law, Ta-ra-bya Tsau-kai, governor of the district of A-myin. He was chosen king near the close of the year 729; but by the advice of the astrologers, he did not ascend the palace until the beginning of the year 730. He took the title of Meng-kyí-tswá-tsau-kai. This king was already married to a granddaughter of A-theng-kha-yá Tsau-ywon, the first king of Tsa-gaing. Her name was also Tsau-úm-ma, with the prefix Tsa-gaing, to distinguish her. The descent of Meng-kyí-tswá, both from the old race of the Pugán kings, and from the family of the three Shan brothers, is then carefully traced in the Ma-lá-Rá-dzá-weng. It is shown in the following table.



By this pedigree Meng-kyí-tswá was only on his mother's side descended from the family of the famous three Shan brothers. His father Meng Sheng Tsau, was the son of the deposed king of Pugán, the last of the ancient race who held sovereign authority. From the internal evidence of the history, this appears very doubtful, as the chief influence in the government is evidently among those of Shan race. It is probable that this pedigree has been arranged in later times.

Of the early history of Meng-kyí-tswá and his father, it is stated, that during the disturbances after the second invasion by the Chinese, and the murder of king Kyau-tswá by the three Shan brothers, the king of Arakan invaded the province of Tharet-myo, where Meng-Sheng-Tsau, a son of king Kyau-tswá, was governor. He and his family were all taken prisoners and carried to Arakan. After a time they were released, and Meng-Sheng-Tsau brought his family to Pán-ya. His youngest son was sent to Tsa-gaing, where Ta-ra-byangai was then king. The son became a favourite with that king, and his former name was then changed to Ta-ra-bya. He received an appointment, and gradually acquiring much influence, was at length made governor of the province of Amyin. The year after Meng-kyí-tswá obtained the throne, he went out with a large retinue to repair the great tank of Meit-htí-la, which had burst its banks. While digging there, they found several golden images with inscriptions, which showed, they represented the sons and daughters of the race of the Leng-dzeng kings of Siam. The king on inquiring from an old man of the place, was told there was a tradition that these had been buried by king Aloung-tsí-thú (who died A. D. 1160), who originally dug or embanked the tank; and it was said the images were those of the rulers who should come hereafter. In the year 732, Tsheng-phyú-Sheng-Bingyaú, king of Hantháwa-tí, sent ambassadors with a letter and presents to Meng-kyí-tswá. The two kings agreed to have a friendly meeting on the border of the two countries. This was done. They gave mutual pledges of friendship, exchanged presents, feasted together, and then separated. The same year the chiefs of Ka-lé and Mo-nhyin fought together. Each applied to the king of Ava for aid, and tendered his allegiance. But

the king, by the advice of his wily minister Tsín-ta-pyít-gyí, let them fight until they were exhausted and then dominated both.

In the year 735, Meng-Bhi-lú the king of Arakan died. There being no direct heir, the nobles of the country offered the throne to Meng-kyí-tswá. By the advice of Tsín-ta-pyít, he would not keep that country as a part of his dominion, on account of the difficulty of controlling it; but he appointed his uncle Tsau-mwun-gyí as a tributary king. That prince proceeded with a force, and established himself in that country. In the following year, messengers with presents arrived from the chief of Zimmay. At this time, the king's elder brother Tsau-ran-noung was governor of the province of Prome. In the year 738, he with much apparent cordiality invited the chief of Toungú, Pyan-khyí-gyí, to a friendly interview and then murdered him. The king derived great satisfaction from this event, and in his joy sent his brother a royal robe and regalia. In the year 742, the king of Arakan Tsau-mwun-gyí died. By the advice of Tsín-ta-pyít, the governor of the province of Ta-lúp, named Tsau-mí, was selected to succeed him. But he grievously oppressed the people, so that they rebelled. He was obliged to fly, and crossed the mountains to Tsa-gú. The Arakanese then placed on the throne Kyau-tswá, the grandson of Nan-kya-gyí, and remained independent.

In the year 745, Tsheng-phyú-Sheng-Bingyaú, king of Pegu, died. He was succeeded by his son Bingya-nwé, styled Rá-dzá-dí-rít. At that time, Louk-byá was chief, or king, of Myoung-mya in the province of Pu-thein or Bassein. Mut-ta-ma (Martaban) was subject to king Byat-ta-ba. In 748, the chief of Myoung-mya proposed to the king of Ava a combined attack on Han-thá-wa-ti (Pegu), begging him as superior to take the kernel of what was acquired, and leave to Myoung-mya the husk only. The king consulted with his great men, and it was determined to invade Pegu. The king's eldest son, the crown prince, led a force down towards Pegu by the Toungú route, through the valley of the Poug-loung river. A second column under the king's second son, Meng-Tshwé, marched by the Iráwati route, through the province of Tha-rá-wa-ti. The left column advanced, and took the city of Pan-gyau. The right column took the city of Hlaing. But the two princes were not able to combine their forces, and though in some actions they were successful, yet the

younger prince suffered a severe defeat from the king of Pegu. The two princes then consulted, and as the rains were near at hand, when military operations by land in Pegu are impracticable, and as Louk-bya did not appear to render assistance, they retreated. The king of Pegu, fearing another attack, sent presents and a letter to Meng-kyi-tswá. These were well received. But the Myoung-mya chief also sent to make excuses for his failure to co-operate, and urged another invasion of Pegu. In the following year, therefore, the king sent another army. The advance was made only by the line of the Iráwati. The force consisted of a large army, and a considerable flotilla, which the king accompanied in person. The king's son Pyín-tsin-meng with a force was left to guard the capital. In passing down the Iráwati, the Mgonng-mya chief joined the king at the entrance to the Pu-thein river. The Burmese force again marched to Hlaing and the town of Mau-bí. The Talaings there had strong stockades, which the king of Ava could not take. His army suffered much from sickness, and he was obliged to retreat without effecting anything.

In the year 751, the king married his son Meng-Tshwé to the daughter of Tho-ngan-bwá, the Shan chief of Mau. The same year the king's ally, Louk-bya, the chief of Myoung-mya, was attacked by Rá-dzá-di-rít, king of Pegu. Louk-bya was taken prisoner. His son Phya-kwan, and his son-in-law Phya-kyín fled, and took refuge with Meng-kyi-tswá. The former received the district of Tsá-leng, and the latter that of Prome, each for his support. In the same year the king of Pegu, suspecting the loyalty of his son Pau-lau-kyan-dau, determined to put him to death. The prince went to the great pagoda at the city of Pegu, with those who had been sent to kill him, made offerings, and thus prayed: "If I have imagined the least  
"evil against my royal father, may this body when it dies, suffer in the  
"eight great hells, and in the hundred and eighty-eight small hells;  
"and may I never meet the future Phra. But if I have not imagined  
"any evil against my royal father, then when this body dies, may it  
"be conceived in the womb of a royal Mran-má, and be born; and  
"when of age, may I conquer and oppress the Talaing country." Having uttered this imprecation, the prince drank the water of truth, and was forthwith killed by the executioners. All this was

told to the king his father. Prince Pau-lau-kyan-dau trans-migrating, was conceived in the womb of Sheng-mi-nouk, the consort of Meng-Tshwé, son of king Meng-kyí Tswá. When she became pregnant, the princess desired to eat a mango from a tree at the city of Da-la, in the Talaing country, and to have other dainties therefrom. Her husband, the Pyin-tsing Prince Meng Tshwé sent a messenger with a letter and presents to the king of Pegu, asking for his request to be complied with. The king of Pegu returned presents of fruit, which the princess ate of, and in due time, in the year 752, gave birth to a son who was named Meng-rai-kyau-tswá.

No event of great consequence occurred during the rest of the reign of Meng-kyí-tswá-Tsaukai. He reigned thirty-three years.

His son Tsheng-phyú-Sheng succeeded him, but reigned only seven months, when he was murdered by Nga-nouk-tsan, the governor of Tagoung. The next brother, Pyin-tsing-Meng-Tshwé, was then placed on the throne in the year 763 (A. D. 1401). He is also called Meng Khoung. In the year 765, the king of Arakan, named Htau-ra-gyí made an incursion into the provinces of Yau and Loung-Shé. The king determined to send an army into Arakan, in order to punish the perpetrator of this insult. His son Meng-rai-kyau-tswá, though only thirteen years of age, was sent with the force. The army of the king of Arakan was defeated, and he himself was slain. The Burmese then occupied Arakan, and the governor of Ka-lé, a son-in-law to king Meng Khoung, was made king of that country with the title of A-nau-ra-htá. Prince Meng-rai-kyau-tswá then returned home.

In the year 766, the king of Han-thá-wa-tí, Rá-ma-ngya or Pegu, styled Rá-dzá-di-rít, collected a great fleet of boats and a large army, and advanced up the river Irá-wa-tí. King Meng Khoung collected a force to oppose him. But the Talaing king was all powerful on the river. He reached Prome, but did not dare to land and attack it, as it was defended with cannons and muskets.\* His fleet then went on to Myé-dai, which also could not be taken. But he captured all boats upon the river, and steadily proceeded up the stream. He reached Ava, but not entering that city, remained at Tsagaing on the opposite

\* As the year 766 of the Burmese Era would correspond to A. D. 1404, the allusion to guns and *muskets* in Burmah, is rather remarkable. The earliest, though doubtful, allusion in Indian History to guns and gun-carriages refers to the year 1368. *Vide Elliott's Historians*, p. 353. THE EDITOR.

bank. King Meng Khoung was much alarmed, but a religious man of Pán-ya, a man of great learning, styled Tsa-gyo-thú-myat, undertook to make the king of Pegu, by the mere force of knowledge and eloquence, abandon his enterprize and return to his own country. The king of Ava wrote a letter to the king of Pegu, and Tsa-gyo-thú-myat was admitted to an interview with the latter on board the royal state boat. A long conversation on religion and the duties of kings ensued. The result was, that king Rá-dzá-di-rít, persuaded by the eloquence of the religious man, that peace was good for all people, and the only consistent course for a pious king, determined to return to his own country. Before leaving, he took to pieces his own golden boat, to build a monastery at Shwé-kyet-yet, near Tsa-gaing. But notwithstanding this abandonment of his expedition, he again invaded Burma in the following year. He, as before, advanced up to Prome with a vast flotilla. The king of Ava came with an army to defend that city. The king of Pegu divided his forces to blockade the city, and placed a strong body of men on the northern side of it. But before this could be accomplished, a quantity of rice laden on horses was thrown into the city, which thereby was saved from famine. The king of Pegu now established himself on the west bank of the river. His flotilla kept the stream in his power, but three of his regiments, left isolated on the land to the north of the city, were attacked and cut to pieces. Though not able to take Prome, the king of Pegu was still master on the river. He sent three hundred boats up the stream, which burnt Mye-dai, Tha-ret and other cities to the north, and ravaged the country, from whence the Burmese army drew their supplies. This forced king Meng-Khoung to sue for peace. At first, Rá-dzá-di-rít sent an unfavourable reply. He referred to the reception given by the king of Burma to his rebellious subject, the chief of Myoung-mya, and returned the presents offered him. The king of Burma had taken prisoner a Talaing nobleman, styled Tha-mein-dzeip-byai, who had two daughters in the palace of the king of Pegu, and both of whom had accompanied him in his expedition. The king of Burma now offered this nobleman his liberty, if he influenced his daughters to persuade Rá-dzá-di-rít to make peace. The king of Pegu, through their entreaties, and against the advice of his nobles, again entered into negotiations.

The two kings exchanged presents and, on an appointed day, proceeded together on foot, and hand in hand, to the great pagoda which crowns a hill overlooking the Iráwati. There they solemnly promised to observe their engagements to each other. The boundaries of their kingdoms were marked out, the city of Prome being allowed to belong to Burma, and the kings then separated. Afterwards the king of Pegu married the sister of king Meng Khoung, the princess being sent by land from Ava by the POUNG-LOUNG route. The marriage was celebrated on the frontier in a pavilion or temporary palace, "whereby," says the history, "the two kings were united as one piece of gold, and their friendship was warm as living fire, and clean as pure water."

But this good understanding was of short duration. In 768, king Meng-Khoung made Meng-rai-kyau-tswá, his son, Ein-Shé-meng or crown prince, and married him to the daughter of Ta-ra-phyá-gyí, the governor of Pu-khan. The king's brother Thí-ri-dze-ya-thú-ra, governor of Tsagaing, was offended at the young prince being raised to this distinction. He raised a rebellion, but was defeated and made prisoner. The king pardoned and released him; but he fled and took refuge with the king of Pegu, whose sister he had married. He was received with distinction, and from that time the king of Pegu no longer sent presents or tribute which, since the last arrangement, he had been accustomed to do.

In Arakan, after A-nau-ra-h tá had been placed on the throne, the son of the deposed king Htau-ra-gyí, named Na-ra-meit-hla, fled and took refuge with king Rá-dzá-di-rít. When the brother of the king of Ava arrived in Pegu, at his suggestion, an army was sent by the king of Pegu to Arakan to support the cause of Na-ra-meit-hla. This army, under the command of Tha-mein-phyat-sa was successful. The king of Ava's son-in-law, Anau-ra-h tá, and his wife, the king's daughter, were taken prisoners, and sent to Pegu; while Na-ra-meit-hla was placed on the throne of Arakan. The king of Pegu put A-nau-ra-h ta to death, and his wife he made one of his principal queens. At this cruel and treacherous conduct king Meng-Khoung was much enraged. But as he and his enemy were nearly matched, he determined, before going to war, to form alliances, so as to be able to crush his foe at once. He addressed the king of Zimmay, informing him

of the bad faith of the king of Pegu after he had sworn friendship at the pagoda of Prome, and invited him to join in an invasion of Pegu. The letter was intercepted, and the messengers were seized. But Meng Khoung in his anger determined at once to go to war. In vain his faithful ministers represented to him the great difficulty of penetrating into a country like Pegu at the season of the year when the rains were nigh at hand. The king would brook no delay. A large force under his own command, marched from Ava by the Tounghú route, in the month of Katshun 769. A force was left at the capital to preserve order, and several regiments were posted at Prome to guard that frontier, and collect and forward provisions for the army by the Iráwati river. The king of Pegu made great preparations, to meet this attack. His army marched from the city of Han-thá-wa-ti, and took post at the city of Tha-kyín. His advanced guard under La-gwun-ein met with a repulse, and the Talaing army retreated to Pan-gyau, to await reinforcements soon expected from Pu-thein and Mut-ta-ma. The Burmese now burnt all the towns and villages of the country they occupied. But the rainy season having set in, it was found difficult to supply provisions, and the Peguan army being reinforced, was enabled seriously to interrupt the communications of the Burmese. The latter now began to suffer from hunger, and king Meng Khoung was advised by his ministers to negociate. But the wily king of Pegu wished to take him prisoner, and invited him to a meeting at the Kyaik-go Pagoda. This was agreed to; but, at the last moment, the king of Ava, suspicious of treachery, would not keep his engagement. The Talaing officer La-gwun-ein then undertook to seize king Meng Khoung by a sudden night attack. In this he was accompanied by the refugee prince, the former governor of Tsagaing, who was to recognize his brother king Meng Khoung. La-gwun-ein penetrated into the Burmese entrenched camp, and even into the king's *tai*, or booth, but failed to capture him. Rá-dzá-dí-rít suspecting that the prince had not given hearty assistance, put him to death. This desperate night attack, which had well nigh succeeded, deeply alarmed king Meng Khoung. He now determined to retreat, himself leading, while the rear guard was commanded by an officer, styled Ra-may-then-tsí. The king of Pegu despatched La-gwun-ein in pursuit. He, marching

rapidly by jungle paths, fell on the Burmese and killed many. The retreating army became utterly scattered, and the king mounted on a swift female elephant to escape. The army now flying helter-skelter, became like a bale of cotton unloosed to the wind. The queen Sheng-mi-nouk was taken prisoner, and being carried to king Rá-dzá-di-rít was taken into his harem. The chief queen, the howdah of whose elephant became loose and swung round, with difficulty escaped on another elephant. The rear guard alone preserved discipline, and the Talaings seeing them stand like a stockade of iron dared not attack them. The king on reaching his capital was in deep distress. His minister consoled him by relating many instances, where weak and insignificant creatures had been successful over those far their superiors, because those superiors could not overcome the obstacles of nature. Hearing these words, "the burning distress of king Meng Khoung was assuaged, as fire is quenched by water."

But the king could not forget the insults and injuries he had received from the king of Pegu. In the year 771, he again invaded that country. The expedition was unsuccessful, but from the cautious manner of proceeding, was not so disastrous as before. The Burmese, the history states, had guns and muskets at this time.

As all the direct attacks on Pegu had failed, another plan and another point of attack were now adopted. The king's eldest son Meng-rai-kyau-tswá, the strange story of whose birth in the year 752 has been related, now besought his father to appoint him to lead an army, to rescue his mother and sister from captivity. A large army was collected, and marched in the year 772 (A. D. 1410), by the Iráwati route. A large fleet was in company. The force proceeded down and entered into the province of Pu-thein (Bassein). The prince first attacked the town of Myoung-mya, but failing to take it, proceeded to Pu-thein. Finding that there were many guns mounted there, he blockaded the city, but could effect nothing. It was now suggested by one of the generals, that they should proceed into Arakan, the king of which country had been supported by their enemy, the king of Pegu. This advice was adopted. The Prince returned to Prome and from thence crossed the mountains into Arakan. The king Na-ra-meit-hla was defeated, and fled into the

Ku-lá country. The Prince appointed Let-ya-gyí governor. The southern part of Arakan, the province of Than-dwai (Sandoway), was placed under Tsuk-ka-té. The prince then returned to Ava where he was received by his father with great distinction.

The Arakanese nobles now applied for assistance to king Rá-dzá-di-rít. He sent an army in the following year, 773, which took possession of Sandoway. Prince Meng-rai-kyau-tswá was again sent to take it. He failed in an attack, but blockaded the town, and reduced the garrison to great distress. The soldiers were obliged to eat their very shields. The Talaing commander now had recourse to a cunning artifice. He caused a false despatch to be sent addressed to himself, announcing the advance of a large force coming to relieve him, and managed to have this intercepted by the Burmese. The Prince called a council of war, and they considered it best to retreat. He returned with his army to Ava. The Talaing army then marched on to the capital, Arakan city. As the Arakanese and the king of Pegu were closely allied, the governor Let-ya-gyí who had been put in by the Burmese, retired.

In the year 774, the Tsau-bwá of the large Shan state of Thein-ní was preparing to attack Ava. Information of his preparations was given by the Tsau-bwá of Ün-boung, and Prince Meng-rai-kyau-tswá was sent against him. The Tsau-bwá of Thein-ní engaged the prince's army, but was defeated and slain. The sons and son-in-law of the Tsau-bwá shut themselves up in their fortified city, and called in the Chinese to help them. The prince, hearing of the advance of the Chinese army, proceeded by night with a part of his army, and lay in wait in a thick wood. Suddenly attacked they were utterly defeated. The prince then returned, and re-invested Thein-ní. In the mean time Rá-dzá-di-rít, king of Pegu, hearing that the Burmese were occupied with Thein-ní, determined to attack Prome. On account of the guns, he was forced to keep at a distance, but hoped to starve out the garrison. While thus employed, hearing that a Siamese army was attacking Mut-ta-ma, he left his son Bi-ngya-Pu-thein in command, and returned himself to Pegu. The prince Meng-rai-kyau-tswá having settled affairs at Thein-ní, arrived at Prome. The king of Pegu also returned there from the lower country. After many skirmishes, the Talaing force was finally defeated, and compelled to

retire down the river. The Burmese pursued as far as the entrance to the Bassein river. The Prince determined to follow up the fugitives. He took possession of Da-la, of Da-gun and Than-lyeng (Syriam). Pu-thein and the whole of the western portion of the Delta of the Irawatí submitted to him. Seeing such great success, king Meng Khoung himself arrived. Numerous partial actions took place in the difficult country of the Irawatí delta, but nothing decisive was accomplished. The king of Pegu stirred up the Shan chief of Nga-thai-wí to attack the towns and villages in the Ava territory. This he did, and prince Thí-ha-thú, who remained at home at the head of affairs, reporting the threatening state of affairs, the Burmese army was withdrawn.

But the prince, considering that he had almost been able to take the capital of Pegu, and was only prevented by accident, determined to try his fortune once more. In 776, the army went down the river, and advanced towards Pu-thein. After some difficulty, the stockade of Khai-boung was taken. The prince, however, could not take Pu-thein, and determined to return himself to Ava apparently to obtain reinforcements. He took with him several prisoners of high rank, but remained there only seven days, and then returned to Pegu, bringing his wife with him. He established himself in the province of Da-la, but the city of that name appears to have been held by a son of the king of Pegu, styled Bi-ngya-Da-la. Meng-rai-kyau-tswa built several large boats, and having made himself liked by the men in command under the king of Pegu, the cities of Pu-thein and Myoung-mya submitted to him.

At this time a serious difficulty threatened the king of Ava. Two Shan chiefs of the states of Mau-dun and Mau-kay had attacked Myé-dú which was subject to Ava. The king had therefore punished them, and they took refuge in the Chinese territory. They petitioned the Emperor of China that their wives and children were held in captivity by the Burmese, and asked for justice. A Chinese army therefore marched into the Burmese territory, and came down to Ava. After about a month, they became straitened for provisions, and sent a message to this effect: "You neither give up the wives and children of the chiefs of Mau-dun and Mau-kay, nor do you come out to fight. We will remain thus for three years. Or, if you will not

“negociate let a horse soldier from each army engage in single combat ; “if our horse soldier loses, we will retire ; but if yours is defeated give “us up the wives and children of the chiefs.” On hearing this, king Meng Khoung was much disturbed, as his best soldiers were all in Pegu. But one of the prisoners, brought to the capital by the prince, named Tha-mein-pa-rán, an officer of high rank and son-in-law to the king of Pegu, agreed to fight the Chinese champion. The duel was fought on horseback, and though the Chinese, or Tartar, was clad in armour, the Pegu chief came off victorious. The Chinese, true to their word, then withdrew to their own country.

In Pegu, the Burmese Prince Meng-rai-kyau-tswá was closely besieging the city of Da-la, which was held by By-ngya-Da-la, one of the sons of the king of Pegu. Rá-dzá-di-rít was anxious to communicate with his son, but was unable to do so. One of his nobles, Ai-mwun-ta-rá planned to enter the place himself by pretending to desert to the Burmese. This was approved by the king. He was received with great joy by the Burmese prince, was entrusted with a command, and during a skirmish managed to enter the city of Da-la. The Burmese now considered they had him safe. But after a few days, he let himself be launched on a raft bound up as a corpse upon the tidal stream, and so passed unmolested, floated by the tide, through the Burmese camp and war-boats. When passed danger, he rose up and proceeded at once to his master at the city of Pegu. Having reported all he had seen, king Rá-dzá-di-rít determined to relieve Da-la. He therefore marched with a considerable force, and Prince Meng-rai-kyau-tswá was obliged to retire. He entrenched himself at a distance. The city of Da-la was thus relieved. Rá-dzá-di-rít now, after much manœuvring provoked the Burmese Prince to leave his stockade and come out to fight. The prince was confident and boastful. He had dosed his elephant with spirits, and had drank some himself. He pushed forward with a small force in front of the main body of his army. With a few horsemen he made great slaughter among the Talaing army, but his elephant became blown, and the Talaing chiefs seeing he had no support at hand, surrounded him with thirty elephants. His elephant was wounded by a hundred darts and disabled. The Prince dismounted and received a severe wound in the thigh, either from a spear or an elephant’s tusk. He

was borne to the bank of a tank and laid down. Here he was taken prisoner and carried before the king. Rá-dzá-di-rít addressed him kindly, but he replied that he desired only to die, as he was unable to fulfil his oath to reach the city of Han-thá-wá-ti. He died the next morning, being the fourth of the waxing moon Ta-gú in the year 778 (April 1416). His funeral obsequies were honorably performed by the king. The morning of his death a palm leaf with the news written thereon was tied round the neck of a tame vulture belonging to the chief Theng-ga-rá-dzá. The bird was let loose, and the same afternoon at the striking of the third watch reached Ava, and flew to the chief Phun-gyí, who presented the writing to king Meng Khoung.

After the death of the prince, the Burmese commanders in Pegu, though successfully resisting attack, were forced to retire. The princess lamenting the death of her husband retired also, and on reaching Ava, was married to Thí-ha-thú, her first husband's brother. But before the whole army had left the Pegu territory, king Meng-Khoung appeared, as he determined to visit the grave of his son. The bones as buried by king Rá-dzá-di-rít were dug up, and placed in a golden vase, which under cover of a white umbrella, was borne in a state boat to Ava.

In the year 779, another expedition was sent against Pegu under the command of prince Thí-ha-thú, who now had been made Crown-Prince. He captured the stockade at Da-gun, and took prisoner Bi-ngya-tsek, one of the sons of the king of Pegu. The Prince could not take Than-lyeng (Syriam), but captured Mau-bí, and remained there entrenched for the rainy season. King Rá-dzá-di-rít who much feared an attack upon his capital, went for safety to Mut-ta-ma (Martaban). After this, the Burmese Prince returned to Ava taking his prisoner with him.

King Meng Khoung undertook no more wars. He sought only to treasure up merit by the performance of good works. The internal affairs of the country were wisely administered. The king dreaded lest he should be ill-spoken of. In the year 784, his destiny was fulfilled, and he died after a reign of twenty-one years.

King Rá-dzá-di-rít also heard with grief the death of his former enemy, and now only thought of religious duties. After one year,

while hunting a wild elephant to capture it with a noose, he received a wound of which he died.

Prince *Thí-ha-thú* succeeded his father. He also took the title of *Tsheng-phyú-sheng*. In Pegu, *Bi-ngya-Dham-má-Rá-dzá* succeeded his father *Rá-dzá-di-rít*. This king's two younger brothers *Bi-ngya-ran* and *Bi-ngya-kyan* rebelled, and occupied the cities of *Da-gun* and *Than-lyeng*. But the first soon submitted; the other brother sent messengers to king *Thí-ha-thú* for assistance. That king at once sent a force which joining the rebel prince took possession of *Dala*. The Burmese commander made the *Talaing* inhabitants prisoners of war, which provoked the resentment of the prince, and a quarrel arose. The result was, that the Burmese force retired. But the two brothers of the king of Pegu were now once more in rebellion. *Bi-ngya-kyan* retired to *Mut-ta-ma*, while *Bi-ngya-ran* occupied *Da-gun*. King *Thí-ha-thú* now sent a larger force to Pegu, which marched in the month *Nat-dau* 784. They proceeded by the *Pu-thein* (*Bassein*) route, which the Burmese had always found the easiest, and took *Dala* once more. Prince *Bi-ngya-ran* entered into negotiations with them, and a marriage between his sister and king *Thí-ha-thú* was arranged. But this was the immediate cause of his destruction. For his chief queen *Tsau-pho-may*, who had been one of his father's queens, offended at his neglect of her, called in a Shan chief *Ūn-boung-lay*, who came with an army to attack the city. The king met him, but was wounded, and fled to *Mo-nhyin*, where he died soon after, having reigned four years.

The nobles now joined and attacked the Shan army, which retired. An infant son of *Thí-ha-thú*, named *Meng-hla-ngay*, was raised to the throne. But the queen *Tsau-pho-may*, who had long been too intimate with the chief of *Ka-lé*, *Kyé-toung-ngyo*, called him in. He came with an army, killed the infant king, and seized the palace.

This usurper's reign was short. The governor of *Mo-nhyin*, named *Meng-nan-tsí*, was a man of much influence. He was of Shan descent, but claimed also to be descended from the ancient kings of *Pu-gán*; his paternal grandmother was a daughter of *Ngá-tsí-sheng Kyau-tswa*, one of the kings of Shan race who reigned at *Pan-ya*, and who died in 712. In the present state of affairs, he determined to assert his claims. He came with a large force and invested *Ava*.

Ka-lé-kyé-toung-nyo being deserted by most of his supporters, fled, together with the queen Sheng-pho-may. Meng-nan-tsi therefore now took possession of the palace in the year 788 (A. D. 1426). The usurper who had fled, died in the jungles on the way to Arakan. Queen Tsau-pho-may who had been consecrated queen in the time of Meng Khoung returned, and was received back into the palace with her former rank.

The king assumed the title of Mo-nhyin-meng-ta-rá. He was forty-seven years of age, when he came to the throne. Many of the provinces gave him trouble by rising in rebellion, but he gradually reduced them. The ruler of Toun-gú was Tsau-lú-theng-kha-yá. Being invited by the king, he came to Ava with a large escort. The king received him with great distinction, and they sat on one couch. From this time the ruler of Toun-gú acted as if he were independent. His younger brother was the governor of Pongday. He became subordinate to the king of Pegu, and by that means was made governor of the province of Tha-rá-wa-ti.

In the year 792, the ruler of Toun-gú and his brother of Pongday, induced the king of Pegu to undertake an expedition against Prome. An army and fleet were sent under the command of Thamein-pa-rán, who formerly, when a prisoner at Ava, fought and killed the Chinese champion. King Mo-nhyin-meng-ta-rá desired to temporize, and by the advice of his ministers sent a friendly message to the king of Pegu with presents, and went down to Prome to meet him. The two kings remained at some distance from Prome carrying on negotiations. In the mean time, the commander-in-chief, Thamein-pa-rán, who had formerly known one of the Burmese chiefs, Rá-dzá-theng-gyan, used to go and see him. On one of these occasions, Mo-nhyin-meng-ta-rá ordered him to be detained as a prisoner, until the traitor governor of Pongday was delivered up. This was at length agreed to, and the two kings concluded their negotiation by an agreement of friendship. A niece of the king of Ava also was married to the king of Pegu. These events occupied several years. King Mo-nhyin-meng, on his return to Ava in 799, attended to the internal affairs of his kingdom. The reckoning of time was found to be much deranged, and great affliction for the people of the country was anticipated, unless the calender was reformed. The king knew

that his royal predecessors who had altered the style in their days, never survived long; but for the benefit of his people, he did not hesitate to do what was required for their welfare. He felt confident also, from predictive signs, that his posterity for seven generations would fill the throne. To adjust the era, the year 800 was counted as 798, two years being struck out. The king died in the following year after a reign of thirteen years.

He was succeeded by his son Meng-rai-kyau-tswa in in the year 801 (A. D. 1439). This king turned his attention to the affairs of Toungú. The king of that country had died in the year 798, and was succeeded by his son-in-law U'-za-ná. The following year, the king of Pegu, Bi-ngya-ran deposed U'-za-ná, and placed on the throne Meng-tsau-ú, son of Tsau-lú-theng-kha-rá. After that ruler had reigned five years, the king of Ava sent a force which dethroned him, and Ta-ra-byá, a Shan chief, was made governor or tributary king. The chief of Mo-goung was at this time independent, but the king coerced him through the Tsau-bwas of Mo-nhyin and Ka-lé. Meng-rai-kyau-tswá died after a reign of three years. He left a daughter; and his youngest brother, Thí-ha-thú, governed at Prome. At first, the nobles thought it better to offer the throne to Thí-ha-paté, the son-in-law of the late king. But he refused to be king, so the nobles went down to Prome, and brought up the prince in great state to Ava. He assumed the title of Bhu-reng Na-ra-pa-ti.

The northern Tsau-bwas submitted to this king, and he reduced to obedience the governor of Ra-may-then, who had rebelled. But suddenly a great danger threatened the king. His son, the crown-prince had been sent with a force to reduce the Shan chief of Peng-lay. While the army was there, a large Chinese army under four generals appeared. The king hastily recalled his son to Ava; left him there in command, and himself proceeded out with his army and took post at the Mandalé hill, a few miles to the north of the city. The Chinese commander remaining at Maing-mau on the Shwé-lé river, sent a message by a party of three hundred horsemen saying, "Will you, as in the time of the Pugán kings, present vessels of gold and silver, or will you make war?" King Na-ra-pa-ti replied, that since the city of Ava had been built, no such demand had been made, and that he would give nothing. On receipt of this message, the

Chinese generals marched to Ba-man, and began to construct a bridge of boats to cross the river Iráwati. This was in the year 806, and the king now advanced up the river with a large number of armed boats besides his land force, as far as Ta-goung, having his army partly on some islands on the river in that neighbourhood. The Chinese commanders now demanded that the Mau chief, Tho-ngan-bwa, Tsau-bwa of Mo-goung, should be delivered up to them. The king refused to do so, and the Chinese brought their army to Koung-dun. There a great battle was fought. The Chinese were defeated, two of their generals were killed, and besides as they suffered from want of food, they retreated towards their own country, and took post at Mo-wun on a tributary of the Shwé-lé river. The chiefs of Mo-goung and Mo-nhyin watched them with an army at Ba-mau, and the king returned to Ava.

In the year 807, the ruler of TOUNGÚ, Ta-ra-byá died, and the king now appointed his younger brother Meng Khoung-ngai, who was Ta-ra-byá's son, according to some authorities, to succeed him. The same year, the Chinese returned with a still larger army than before. The king was recommended by his ministers to comply with their demand. He remained in camp near Ava, and awaited their arrival. The Chinese generals on their arrival demanded the chief Tho-ngan-bwa as their subject. The king replied, he was his subject, but still if they would do him a service, he would comply with their demand. The service was to attack the chief of Ra-may-then, named Meng-ngay-kyau-hteng, who was in rebellion. The Chinese generals agreed, and performed the service required. They then returned to Ava. But the chief Tho-ngan-bwá took poison, and died. The king delivered the dead body to the Chinese. They took out the bowels; run a spit through it and dried it with fire, and then carried it away. The reason why the Chinese demanded Tho-ngan-bwá was, that his grandfather Tho-khyí-bwa had formerly been in rebellion against the Emperor of China, and had fought against him. This quarrel had never been satisfied, and so the grandson was demanded.

In the year 808, the son of Bi-nya-Dham-má-Rá-dzá, late king of Pegu, named Bi-nya-kyan, having quarrelled with his uncle Bi-nya-ran-Khaik then on the throne fled, and came to Pu-gan

where king Na-ra-pa-tí then was. The same year the king of Pegu died, and was succeeded by Bi-ngya-pa-rú, nephew to Bi-ngya-ran.

In 811, a Chinese army again invaded Burma, marched down to Bamau, and crossed the Iráwati by a bridge of boats. Their object was to attack the Tsau-bwás of Mo-nhyin and Mo-goung. Mo-goung was now under two Tsau-bwás who were brothers, named Tho-kyin-bwá and Tho-thut-bwá. They, with the Tsau-bwá of Mo-nhyin, bravely met and defeated the Chinese, who then retreated. King Na-ra-pa-tí was very glad of this, and made them a large present in silver.

In the following year, the king of Pegu being killed, the Talaing nobles begged that Bi-ngya-kyan should be made king. Na-ra-pa-tí therefore sent an army which placed him on the throne. But he died in the year 814, and then Leit-mwut-htau, son of Bi-ngya-khaik by his queen, the niece of king Mo-nhyin-meng-ta-ra, was placed on the throne. He at once sent presents to the king of Burma, calling him royal uncle. But he died the following year. Then Sheng-tsau-pú was raised to the throne with the title of Bi-ngya-kyan. She was the daughter of king Rá-dzá-di-rít, first married to her cousin Tha-mein-tsí, and after his death to king Thí-ha-thú of Ava. But after his death, she left Ava, and returned to her own country. Now at the age of fifty-nine years, she was placed on the throne of Pegu.

In 816, King Na-ra-pa-tí had a friendly meeting on the border of the two countries with Alí kheng, king of Arakan.

In 820, the king invaded Toungú, but could not retain his authority there. He also had much trouble with several of the Shan states. His death was caused from a wound received in a struggle with his son, who had raised a rebellion. The king fled with a few followers from the city, and went down to Prome, where his second son was the governor. There he died from the effects of his wound in the year 830, after a reign of twenty-six years. His eldest son succeeded him, and took the title of Bhu-reng Ma-há-thí-ha-thú-ra. In this king's reign, the principal events recorded are his endeavours to retain Toungú under his immediate government. He was troubled with wars between the different Shan states; and his brother in the province of Prome was disobedient. He died after a reign of twelve years. His son, styled Du-ti-ya Meng Khoung, next came to the throne,

and assumed the title of *Thí-ri-thu-dham-má Rá-dzá*. In his reign the troubles of the Burmese monarchy increased. His younger brother, who governed *Ra-may-then*, rebelled, as did another brother in the province of *Tsa-leng*. To the north, the *Tsau-bwá* of *Myé-dú* declared himself independent; and the king's uncle, *Tha-do-meng-tsau*, who held the province of *Tha-rá-wa-ti*, succeeded to *Prome*, and proclaimed himself king. He then advanced up the river *Iráwati* as far as *Ma-gwé*. King *Du-ti-ya Meng Khoung* went down with a force to meet him. After a negociation for about a month, they exchanged presents and separated, without any distinct arrangement having been made. Soon after, the prince at *Tsa-leng* died, and that province then returned to its allegiance. In the year 847, the king, with the view apparently of preserving the loyalty of his eldest son, gave him authority equal to his own. He received the title of *Ma-há Thí-ha-thú-ra*. He lived in the same palace with his father, and each had a white umbrella as the symbol of sovereignty. This measure probably had the effect of preserving the king from being dethroned, but the prince died before his father, after having been associated with him in the kingdom for fifteen years.

The events in *Toungú* at this time were destined to have overwhelming effect on the *Ava* monarchy more than half a century later. They will now be glanced at as being connected with the history of *Du-ti-ya Meng Khoung*. The ruler of *Toungú*, when this king came to the throne, was *Tsí-thú-kyau-liteng* who, like the royal family, was probably of *Shan* descent. He maintained a position almost equal to an independent prince. He died in the year 843, and was succeeded by his son *Tsí-thú-ngai*, who as the history states, was appointed by the king. In the year 847, this prince was put to death by his nephew *Meng-kyí-ngyo*, who assumed the title of *Ma-há-thí-rí-dze-ya-thú-ra*. The history states that he sent presents to the king of *Ava*, who replied, that he did not wish to interfere with *Toungú*, and sent the chief a white umbrella, thereby acknowledging his independence.

In *Pegu*, *Dham-ma Dzé-di* had become king in succession to *Sheng-tsau-pú*. He died in 854, and his son *Bi-ngya-rán* succeeded him. He and the chief of *Toungú* were suspicious of each other, and a border warfare was maintained. The *Toungú* chief had built a new

fort, called Dwá-ra-wa-tí, which the king of Pegu came and attacked with a large army. The chief of Toungú applied to the chief of Tha-rá-wa-ti and also to Du-ti-ya Meng Khoung for assistance. But before the aid could arrive, the Pegu army had been attacked and defeated. The king of Ava now sent the Toungú chief all the regalia in addition to the white umbrella before conferred upon him. The king having bent to the circumstances of the time, preserved his authority in a comparatively small extent of country round Ava, and died after a reign of twenty-one years in 863.

His second son now ascended the throne with the title of Ma-há-Rá-dzá-dhí-pa-ti and also Shwé-nan-sheng Na-ra-pa-ti. The state of the kingdom is now admitted in the Ma-há-Rá-dzá-weng to have been desperate. The Tsau-bwá of Mo-nhyin attacked and took possession of Myé-dú. The king's brother-in-law, the governor of Tsa-leng, having died, his widow married the son of the ruler of Prome, who had taken the title of king, and they declared themselves independent. The king, however, was able to re-establish his authority there for a time. But he was now at open enmity with the chiefs or kings of Prome and Toungú, and in the year 867, invited by two inferior chiefs who were in rebellion, they sent forces to attack the city of Tsa-lé. The king quite helpless called in the Tsau-bwá of U'n-boung to his assistance. The king also marched with the army, and the rebel force with their allies was defeated. In the north, the Tsau-bwá of Mo-nhyin took possession of the province of Ta-ba-yín, but the king was able to recover it. In 869, three of the king's brothers raised a rebellion at Pa-khan-gyí; but they were defeated and put to death. The Tsau-bwá of Mon-hyin, named Tsa-lun, had now become very powerful. In the year 873, he attacked the Tsau-bwá of U'n-boung, because he was friendly to the king. The place he attacked was Ba-mau, which belonged to U'n-boung. The Tsau-bwá requested the king to attack Myé-dú, which had a garrison of soldiers in the service of the Mo-nhyin chief. But the fort was well defended with muskets and jinjals, and the king could only blockade it at a distance. While doing so, his troops were attacked by the chiefs of Ka-lé, Toung-dweng-kyoung and Meng-kheng, who had become tributary to Mo-nhyin. The king's troops were entirely driven away. For several years, king Na-ra-pa-ti was compelled to endure

rebellions ; and in the year 885, the chief of Mo-nhyin, marched with an army of Shans down to Tsa-gaing, clearing the country of such troops as remained under the king of Ava. From thence the chief marched along the right bank of the river Iráwati, and went as far south as the city of Tha-ret, all the cities, towns, and districts submitting to him. While he was at that place, the king of Prome, Tha-do-meng-tsau, a near relation to king Na-ra-pa-ti, now sent presents to Tsa-lun, the Mo-nhyin chief, offering if he would place him on the throne of Ava, to be friendly and subservient. This was agreed to. The Shan army then crossed to the east side of the Iráwati at Mye-dai. The army of the king of Prome advanced up the river in boats. The Shan army marched by land. King Na-ra-pa-ti had no army of his own left to oppose this force, but the Un-boung Tsau-bwá, Khun Mhaing, marched to Ava to assist his friend. Some fighting occurred near the city, in which the Burmese force was defeated, and king Na-ra-pa-ti fled together with Khun Mhaing towards the north-east. When the king of Prome came up, the Mo-nhyin Tsau-bwá, according to his promise, put him on the throne. But after three days that chief retired, and crossing the Iráwati, returned to his own country. The king of Prome could not retain his position, and retired also, taking with him a little daughter of king Na-ra-pa-ti's of eight years old. The king then returned to Ava, together with the Un-boung Tsau-bwá, and once more entered the palace. Khun Mhaing then returned to his own country. The king gratefully offered him valuable presents, which he would not accept. For two more years the king endured his fortune, which was now near its end. In the year 888, the Tsau-bwá of Mo-nhyin again put his troops in motion, and now was accompanied by his son Tho-han-bwá. They marched to Tsagaing, and after defeating such Burmese troops as opposed them, crossed the river, and besieged Ava. After eight days the city was taken by storm. King Na-ra-pa-ti attempting to escape on an elephant, was killed by the hand of Tho-han-bwá. Most of his relations and nobles fled, some to Prome, and some to Toungú. Thus died king Na-ra-pa-ti, after a reign of twenty-five years.

The Mo-nhyin chief was now master of what remained of the kingdom of Ava. He stated that he did not wish to reign himself,

and retired to his own state. His son Tho-han-bwá now assumed the title of king of Ava. His father persuaded Ran-noung, a nephew of the late king's, and a Burmese noble of much experience and ability, to become chief minister. The various provinces which still remained, were placed under Burmese and Shan governors. Tho-han-bwá, against the advice of his minister, desired to attack both Toungú and Prome. The king of Prome, Tha-do-meng-tsau, had died, and was succeeded by his son Bhu-reng Htwé. In the same year also died Bi-ngya-ran, king of Pegu, and was succeeded by his son, Thu-sheng-ta-gá-rwut-pi.

In the year 892 died Meng-kyí-nygyo, king of Toung-ú, who had reigned there for forty-five years. He was succeeded by his son Meng-ta-rá Shwé-htí, whose fortunes will hereafter be connected with the Ava kingdom.

In 894, Tsa-lun of Mo-nhyin, father to the king of Ava, marched down with an army, and he and his son proceeded to Prome. Bhu-reng Htwé, the king of that city, sent his family away towards Arakan, and shut himself up in the city. He was unable to resist the large force brought against him, and was taken prisoner and carried to Ava. Tsa-lun carried him away towards Mo-nhyin; but on the road, he himself fell a victim to a conspiracy of the chiefs under him, and Bhureng Htwé escaped. He returned to Prome. But there his son had become king with the title of Na-ra-pa-ti; and shut the gates against him. He died in the adjoining forests of Na-weng. This Na-ra-pa-ti of Prome had married a daughter of Shwé-nan-sheng Na-ra-pa-ti of Ava. From this time until the year 900 (A. D. 1538), Tho-han-bwá appears to have maintained himself without any material alteration.

In that year, the king of Toung-ú, Meng-ta-rá Shwé-htí, attacked the king of Pegu, who fled and took refuge with his brother-in-law, the king of Prome. From this time the fortunes of the kings of Ava, of Prome, and Pegu were inseparably connected, until they were entirely overborne by the power of the king of Toung-ú.

The Ma-há-Rá-dzá-weng now proceeds to trace the history of that hitherto obscure state. Toung-ú is the name given to a district lying about the middle of the course of the Poung-loung, a small river, the basin of which lies between the Iráwati and the Sal-wín.

The extent of this district was originally not greater than from seventy to eighty miles from north to south, with a breadth of about half that distance. On the east of the valley are high mountains, where the wild Karen tribes are still numerous, and probably from a very remote period held independent sway. The mountains on the west barely exceed one thousand feet elevation, and the Karen tribes are now scarcely to be found there. Gradually Talaing colonists from the south, and Burmese from the north, appear to have occupied the valley of the middle Pong-loung, leaving the hills to the Karens. But for safety, these colonists appear to have had strongholds in the lower hills on the western side of the valley. One of these, which was occupied on the Ka-boung stream, a tributary of the Pong-loung, was called in the Burmese language, Toung-ngú, from its position on a projecting mountain point, and this name has been transferred to the city, afterwards built in the plain, and to the whole district. As long as the seat of the Burmese monarchy was at Pu-gán, Toungú was not much interfered with, but when the capital had been transferred to Pan-yá, the Shan dynasty appear to have been more attracted to it. In the year 679, Thi-ha-thú Ta-tsí-sheng sent his son U'-za-ná Kyau-tswá to this district; he occupied the then existing city, and probably brought Burmese or Shan settlers with him. Later a chief from Pegu, but probably of Shan descent, Pyan-kyí-gyí became king. But after this, a Burmese adventurer Moungh-phau-ká was raised to power, and from this time the kings of Ava looked upon the country as part of their dominion. But the governors were frequently independent, and by allying themselves alternately with the Burmese or the Talaings, managed to maintain a position, which the natural strength or wealth of the country could not otherwise have sustained.

It has already been mentioned that when Du-ti-ya Meng Khoung, king of Ava, came to the throne, in the year 842 (A. D. 1480), the ruler of Toung-ú was Tsí-thá-kyau-hteng. He had a brother, the governor of Ra-mai-then, who had married a grand niece of Mo-nhyin Meng-ta-rá, the Shan chief, who had seized the throne of Ava in the year 788. The family also claimed to be descended from U'-za-ná, the son of Kyau-tswá, the deposed king of Pugán, who had reigned at Pan-yá after the death of his

adopted father *Thí-ha-thú Ta-tsí-sheng*; and also from the half brother of that king, *Nga-tsí-sheng*. The family may be considered as originally Shan, which now had almost become Burman. The governor of *Ra-mai-then* had a son *Meng-kyí-ngyo*, who was sent to *Toung-ú* to be under his uncle *Tsí-thú-kyau-hteng*. The uncle is described as a man of a more savage disposition than even at that time was usual. He decided to break off connection with the king of *Ava*, and entered into friendship with the king of *Pegu*. His nephew *Meng-kyí-ngyo* conspired against him, and put him to death. He then succeeded him in the government of *Toung-ú*, and at once proclaimed himself king in the year 847, being A. D. 1485. He now assumed the title of *Ma-há-thí-ri-dze-ya-thú-ra*. He soon became so powerful, that his alliance was sought by the kings of *Pegu* and *Siam*. In the year 853, he built a new city or fort in a secure position, which he called *Dwá-ra-wa-ti*. He became involved in a quarrel with the king of *Pegu* consequent on border disputes, and his city was attacked, but he defeated the assailants. In the year 863, some nobles who had been in rebellion against the king of *Ava*, fled and took refuge in *Toung-ú*. This produced a war, in which the army of *Ava* was defeated. In 866, as already mentioned, the king of *Toung-ú* made a league with the king of *Prome*, *Tha-do-meng-tsau*, against *Ava*, in support of two rebel chiefs. In the following year their forces advanced up the *Iráwati*, to support the rebellion of the king of *Ava's* brothers at *Pa-khan-gyí*. But the rebellion had been crushed before his troops reached the scene of operations. The king of *Toung-ú* now felt strong enough to build a new city in a more convenient place than that hitherto occupied. The new city of *Toung-ú* was therefore built in the year 872 (A. D. 1510) on the west bank of the *Poung-loung*, and in the midst of the most extensive and most fertile plain of the whole territory. The city was called in *Pa-li*, *Ke-tu-ma-ti*. It is the custom of the *Burmese*, *Shans*, and *Talaings*, to have a *Pali* as well as a vernacular name for their cities and districts, which is used in all official documents. A more ancient name for the territory of *Toung-ú* was *Dzé-yá-wa-ta-na*.

The king of *Toung-ú* appears to have extended his influence and territory towards the north, as the power of the king of *Ava* declined. In the year 888, when the *Mo-nhyin Tsau-bwá* conquered *Ava*, many

of the Burmese nobles fled to Toun-g-ú, and the king of that territory may now be said to have become the representative of the ancient Burmese monarchy. King Ma-há-thí-ri-dze-ya-thú-ra died in the year 892 (A. D. 1530).

The son who succeeded him was Ta-beng Shwé-htí, then only sixteen years of age. He is called in the history Meng-ta-rá Shwé-htí. From his birth many prodigies had announced his great destiny. In the history, in accordance with the strange application of the doctrine of transmigration to account for the actions of great conquerors, which has been noticed before, this prince is represented as the transmigrated prince of Pegu, Meng-rai-kyau-tswá, son of Dham-má-tsé-dí, king of that country, who was unjustly put to death by his father. When dying, he exclaimed, "If innocent, may I be born as a Burmese prince, and subdue, rule over, and oppress the three Talaing provinces." And so it came to pass. The young king from an irresistible internal influence, determined to invade and conquer Pegu.

At this time, the capital of that kingdom was at Mut-ta-má (Martaban). That city was occupied as the seat of power, about the year 713 (A. D. 1351), by a Shan chief, styled Tsheng-phyú-sheng Bi-ngya-ú. The ancient Talaing kingdom, which had its capital at the city of Pegu, was overthrown, and the seat of government removed to Mut-ta-má. In the year 888, Thu-sheng-ta-gá-rwut-bi ascended the throne. In 896 (A. D. 1534), the young king of Toun-g-ú first marched against Pegu. The city was defended by two Shan nobles, Bi-ngya-lau, and Bi-ngya-kyan. They held it so obstinately that Meng-ta-rá Shwé-htí was forced to retreat. In the following year, he again invested it. But from the walls of the city, the foreigners and Muhammadans, called "Kulá Pan-thé," fired so incessantly with jinjals and blunderbusses, and wounded and killed so many, that the king was again obliged to retire, especially as the rainy season was nigh. In 898, he again invaded Pegu. The king of Pegu now met him in the plain of Kau-lá-ya to the north of the city, but was defeated. The city, however, could not be taken. The king of Toun-g-ú therefore passed it by, and marched to Da-gun, the modern Rangoon, and from thence, sent detachments, which took possession of Pu-thein, Myoung-mya, and other cities in the delta of the Iráwati. Still he could not

retain his position, and as the rainy season approached, he once more returned to Toung-ú.

The following year the king of Pegu sent a humble letter to Meng-ta-rá Shwé-htí, proposing peace and friendship. The bearers of this letter were the two Shan nobles, Bi-ngya-lau, and Bi-ngya-kyan, who had defended the city of Pegu. The king received them kindly, but would give no reply. As they could obtain no reply, they returned to their own master. Their king became suspicious of them, and Meng-ta-rá Shwé-htí now had recourse to a deep artifice. He caused a letter to be inscribed on a scroll of gold as follows: "The king of "Dzé-yá-wa-ta-na Ké tu-ma-tí informs his uncles Bi-ngya-lau and "Bi-ngya-ran that, when the affair as before agreed is settled, Bi-ngya-lau shall be appointed governor of Han-tha-wa-tí (Pegu), and "Bi-ngya-kyan of Mut-ta-ma (Martaban), and so be ye diligent in "my royal service." This scroll being enclosed in a cloth bag and placed in a basket, was entrusted to two bold and clever messengers with several followers. They proceeded into the Pegu territory, and at one of the border villages, having entered in a friendly manner, they after a time managed to get into a dispute with the head of the village regarding the provisions brought them. This gradually led to a serious quarrel, and the messengers, as a large number of the Talaing villagers assumed, fled, leaving behind them their baggage and the basket which contained the king's letter. The villagers took everything to their headman, and all was brought to the king of Pegu. The letter was now discovered and without any inquiry, the two noblemen were put to death. The king of Toung-ú now again attacked the city of Pegu, and took it after a slight resistance. The king of Pegu determined to retire to his brother-in-law, the king of Prome, and proceeded up the river. The king of Toung-ú now consulted with his nobles, as to whether it would be better to follow on to Prome or to march against Mut-ta-ma. It was decided to do the former. The king's principal general was Kyau-hteng Nau-ra-htá, who was also his brother-in-law. He was distantly connected by blood with Meng-ta-rá Shwe-htí, and was said to be descended from one of the former kings, or governors, of Toung-ú. This general led the forces of the king to NOUNG-RO, where the king of Pegu had collected an army. Kyau-hteng attacked and utterly defeated that

army. The king of Pegu then fled with his whole family to Prome, where he was received by the king Na-ra-pa-tí.

King Meng-ta-rá Shwe-htí was profuse in his acknowledgments to his general, and bestowed upon him the title of Bhu-reng Nong, intimating that he would be king hereafter. It was now determined to pursue the king of Pegu to Prome, and here the history once more is linked with the fortunes of the king of Ava, Tho-han-bwá, which for a time were dropped, in order to trace the events which brought the king of Toungu from Pegu up the Irawáti to Prome.

The king of Prome hearing that he was to be attacked, had persuaded Tho-han-bwá, king of Ava, to support him. That king came down the river with a large army of Shans. They and the fugitive king of Pegu met at Prome, and took an oath of fidelity to each other. Near Prome, the flotillas of the contending powers had an engagement, in which the allies were defeated, and some of their principal officers were taken prisoners. Meng-ta-rá Shwé-htí either did not then feel himself strong enough to retain Prome, or more urgent affairs called him to Pegu; for he now led his army back to that country. The king of Pegu, Thi-sheng-ta-gá-rwut-bi now desired his allies to invade Pegu. But they were unwilling to do so. He therefore proceeded himself with a small force, but lost his life in the jungle. King Tho-han-bwá returned to Ava, taking with him the children of the king of Pegu. Soon after, the king of Prome, Na-ra-pa-tí died, and was succeeded by his younger brother Sheng Tha-ret, who took the title of Meng Khoung. His sister, the widow of the king of Pegu, was sent to Arakan, where she married the king of that country.

After the death of Thu-sheng-ta-gá-rwut-bi, all the Talaing nobles in Pegu submitted to Meng-ta-rá Shwé-htí. He provided for the most worthy by appointing them to the different districts. But Mut-ta-ma (Martaban) still held out. The brother-in-law of the late king, Tsau-bi-ngya, governed that province, and refused to submit to the conqueror. The king therefore marched with a large army to take the city. On arrival, he found the difficulties enormous. Situated near the mouth of a great river, or an arm of the sea, it was defended with numerous guns; and the Ku-lá Pan-thé (Foreigners and Muhammadans), some on the city walls, and some on board seven

ships, heavily armed, anchored before the city, were ready to defend it. It was in the year 902 (A. D. 1540) that the king besieged Mut-ta-ma. Bhureng NOUNG commanded all the forces under the immediate orders of the king. The boats brought from Pegu were useless; they could effect nothing against the ships. And provisions could not be kept from entering the city, so that the garrison could not be starved. The king of Mut-ta-ma being encouraged by the foreigners would not submit. Meng-ta-ra Shwé-htí, however, succeeded in drawing to his side the governor of Maulamyaing (Maulmain), and through his assistance he had several large rafts of timber constructed, which were piled high with dry bamboos. These were made ready up the river and set afloat to drift down with the tide. When completely on fire, they were directed to where the ships lay, and amidst the great confusion which ensued, three large and four small vessels were burnt. While this was going on, the land army assaulted and took the city. Immense plunder was taken, which the soldiers were allowed to keep, the king only reserving for himself munitions of war. All who resisted or had arms, were killed, but the king by proclamation forbade the soldiers to kill the men of rank. The governor Tsau-bi-ngya, was taken prisoner, and appointed to be governor of Myoung-mya; and the other nobles of the city received what was appropriate. The governor of Maulamyaing was liberally rewarded. He swore allegiance to Meng-ta-ra Shwé-htí, and was confirmed in his previous government of the country, east of the Salwín river. Care was taken to have guards placed on the frontier, to watch Zim-may and Siam.

Having made these arrangements, the king returned to Han-thá-wa-tí (Pegu), where he was solemnly consecrated king of his new dominions. The city now received some additions to make the fortifications more complete.

When Meng-ta-rá Shwé-htí left TOUNG-Ú, Meng-rai-thing-ga-thú, the father of Bhureng NOUNG, had been appointed governor. The king regarding him as his own father, gave him the title of king, with regalia and a palace. He was thenceforth known as Meng-rai THÍ-ha-thú, tributary king of Ke-tu-ma-tí.

In the year 903, Meng-ta-rá Shwé-htí proceeded with a great retinue to Da-gun, made rich offerings, and crowned the building with

a kingly crown. Having feasted the clergy and laity, he returned to Han-thá-wa-tí, and informed Bhureng NOUNG that he would march to Prome after the month Tha-den-gwyut (October), and charged him to make all the necessary preparations. A large army and fleet of boats were prepared, including some boats armed with guns. The city of Pegu was left in charge of Tha-do-dham-má Rá-dzá, brother of Bhureng NOUNG, and Thet-shé-kyau-hteng. The whole of the war arrangements were under the direction of Bhureng NOUNG, and the army moved by land and water from the city of Pegu in the month Ta-tsoung-mun (November).

In the meantime, Meng Khoung, king of Prome, was exerting himself to resist the formidable force which had been gathered against him. Tho-han-bwá, king of Ava, felt that his own safety depended upon supporting Prome. He collected an army, and supported by the Tsau-bwás of Un-boung, Mo-meit, and Mo-nhyin, marched down to Prome. The king of Arakan also having been applied to for help, sent a land column across the hills from Thandwai (Sandoway) under his brother; while another force was sent by sea, round Cape Negrais to penetrate up the Bassein river, and so cause a diversion.

Meng-ta-rá Shwé-htí having reached Prome with his fleet and army, remained at a little distance to avoid loss from the guns. Hearing that the king of Ava, with the northern Shans, was moving down, he sent half of his army to the northern side of the city under Bhureng NOUNG, who suddenly attacked them about one march distant from the city. They were completely routed, the guns of Bhureng NOUNG doing great execution. The Shan army fled to Ava, and there the Tsau-bwás proposed making an attack on Toung-ú, but nothing was done, and they returned to their own countries.

The city of Prome was closely invested, but was too strong to be taken quickly. A letter was now intercepted from the brother of the king of Arakan to the king of Prome announcing his arrival, and that he was about five marches distant. A feigned reply was once sent together with guides, and Bhureng NOUNG was despatched with a force to attack the Arakanese army. Taken by surprise, they were defeated and utterly dispersed, being only saved from destruction by the hilly country, which favoured their flight. The son of the king

of Arakan who had come with the boats by sea, hearing of the defeat of his uncle, returned home. The king of Prome being thus left entirely to his own resources, and the citizens and soldiers suffering from want of food, at length surrendered in the month Na-gun 904 (June 1542, A. D.). King Meng Khoung with his queen and concubines were sent to Toung-ú. Tha-do-dham-má Rá-dzá, one of the brothers of Bhureng NOUNG, was made tributary king of Prome, being invested with the usual regalia. Meng-ta-rá Shwé-htí having made arrangements for the government of the country, placed garrisons in such places as required protection, and returned to HÁN-tha-wa-tí. A number of the nobles, officers and soldiers of Prome, were brought away.

At Ava, the defeat of king Tho-han-bwá had increased his difficulties. His Shan followers had always been hated by the Burmese, whom they cruelly oppressed. In the palace there were both Shan and Burmese guards. The Shan officers had long wished to clear the palace of all Burmese. The latter depended upon Meng-gyí Ran-nOUNG, who supported their interests. The wicked character of Tho-han-bwá caused him to be hated, and facilitated a conspiracy against his life. While he was living at a summer palace, the Burmese nobles and guards were suddenly set upon and killed, and the king himself was seen no more. This occurred the month before Prome was surrendered. This king's character is thus drawn in the Ma-há Rá-dzá-wENG: "He was of a cruel and savage disposition. He "spared not men's lives. He respected not the three treasures. "Pagodas, he used to say, are not the Phrá, but merely fictitious "vaults in which the Burmese deposit gold, silver, and jewels; so he "dug into and rifled those shrines of their treasures. The Phun-gyís too, he used to say, having no wives and children, under "pretence of gathering disciples, collect guards round them, ready "to rise in rebellion. So he built a number of sheds on the plain of "Toung-ba-lú, and pretending to do honour to the Phun-gyís, invited "all those round Ava, Tsagaing, and Pán-ya to a feast. Then sur-rounding them with an army, he had them all slaughtered. He then "seized all the books in their monasteries, and had them burnt. But "some of the Shans had pity on the Phun-gyís, and many thus "escaped to Prome and Toung-u. More than three hundred and "sixty were killed, but more than a thousand escaped."

On the death of Tho-han-bwá, the Burmese wished Meng-gyí Ran-noung to become king. But he refused, and recommended them to choose the Tsau-bwá of Ūn-boung, named Khun-mhaing-ngai, who was a relation to the late king Shwé-nan-sheng Na-ra-pa-tí. The Tsau-bwá accepted the invitation, and came to Ava. He ascended the palace in the year 904. Ran-noung became chief minister, but after about a year, wearied with worldly affairs, he became a Ra-hán in the province of Mek-kha-rá. Khun-mhaing-ngai determined to attack the new king of Prome. He was supported by seven powerful Tsau-bwás, and in the month Nat-dau 905 (November 1543), they proceeded by land and water against that city. The tributary king of Prome, Tha-do-dham-má Rá-dzá, had no force sufficient to meet them in the field, so he shut himself up in Prome, which was well defended with guns. As soon as Meng-ta-rá Shwé-hti heard of this attack, he came to the rescue with a large army. The Shans were defeated near Prome, and Bhureng Noung followed them up the river Irawáti, as far as the city of Pu-gán, which was captured. Governors were appointed to all the provinces which were occupied above Prome, and having made such arrangements for future security as seemed advisable, Meng-ta-rá Shwé-hti returned to Pegu, which he reached in the month Wa-goung 906 (August 1544, A. D.)

The governors who had been appointed to Tsa-leng and other districts, had desultory fighting with the officers of the king of Ava. But the confusion among the northern Tsau-bwás became daily worse. The son of the Tsau-bwá of Mo-nhyin, named Tsa-lun-ngai, leagued with Kyau-hten, who had been governor of Tsa-leng, and enabled him to take possession of Tsa-gaing, where he set himself up as king in the year 907. In the same year died Khun-mhaing-ngai after a reign of three years. He was succeeded by his son, who had been Tsau-bwá of Mo-byé. He took the title of Na-ra-pa-ti. This king did not join with his kinsmen, the Shan chiefs, but entered into friendly relations with Meng-ta-rá Shwé-hti. He strove also to conciliate the ruler of Tsa-gaing, Kyau-hteng. This ruler urged on by the Tsau-bwá of Mo-nhyin, named Tsa-lun, gradually collected forces with the view of attacking Ava. His measures were complete by the year 913 (A. D. 1551), when he had a large force and a fleet, to cross the river and attack Ava. The king Mo-byé-meng, however,

would not wait an attack. He fled from his palace, and took refuge with Bhureng NOUNG, who then had succeeded MENG-ta-rá SHWÉ-HTÍ. The Tsa-gaing chief KYAU-HTENG now took undisputed possession of Ava, and ascended the throne in the year 913.

We must now relate the events which had occurred in the kingdom of Pegu since MENG-ta-rá SHWÉ-HTÍ returned there from Prome in the year 906. That king now turned his attention to settling the internal affairs of his kingdom. He beautified the capital, and built monasteries and other religious works. He adopted several of the customs and the dress of the former Talaing royal family. In the year 907, he was solemnly consecrated as king, having a crown like that used by the Talaing kings, but with all other paraphernalia like those formerly used by the Burmese and Talaing kings. MENG-rai-THI-ha-thú, the king of TOUNG-Ú, was present at this ceremony; and his son Bhureng NOUNG appeared as EIN-shé-meng or Crown-Prince. All the nobles received magnificent presents from the bounty of the king, and the whole kingdom was full of joy.

About this time the king of Arakan died, and his son U-ba-Rá-dzá succeeded him. His brother, who was governor of THAN-dwai (Sandoway), was discontented. He came with presents to the king of HAN-thá-wa-ti, and asked for assistance to gain the kingdom of Arakan. MENG-ta-rá SHWÉ-HTÍ promised himself to go with an army. Both a land force and a fleet were put in motion in the month Ta-tshoung-mon 908 (November 1546, A. D.). The town of THAN-dwai was occupied. The Arakanese retreated, and the Burmese army marched on to the capital city, Arakan. The king found the city too strong to be taken, but he entered into a negotiation with MA-há DHAM-ma-rít, the king of Arakan, by which the king's uncle was recognized as governor of Sandoway. The king of Pegu then returned to his own country.

While he was in Arakan, the king of Siam had marched an army and taken possession of DHA-way (Tavoy). The king of Pegu ordered his officers to drive them out, and this having been done, he seriously meditated a march on Siam. Having assembled his army and made all preparations, he left the city of Pegu in the month of Ta-tshoung-mon 910 (November 1548, A. D.), and proceeded to MUT-ta-ma. All the arrangements as usual were under the direction

of Bhureng NOUNG. The army advanced with great difficulties and much fighting to the capital of Siam. The general, Bhureng NOUNG, was indefatigable in his exertions, and his son, a boy of thirteen years, greatly distinguished himself. But the capital city was most difficult to operate against, on account of the streams and water channels round it. The Kulá Pan-thé people also were there with ships and guns. Seeing that great delay would occur, and fearing a want of provisions, the king determined to retreat. Much fighting took place in effecting this. The son-in-law of the king of Siam had been taken prisoner in a skirmish. This led to negotiations, and according to the history, the king of Siam agreed to pay tribute. Two of his brothers were sent to the camp of Meng-ta rá Shwé-htí to enter into arrangements. The Siamese prisoners were released, and the Burmo-Talaing army retired. This expedition occupied five months.

The history now relates a curious incident in the life of Meng-ta-rá Shwé-htí, which appears to have had an evil influence upon him, and eventually led to his death. It is told as follows: "This powerful  
"and wise king, by associating with a false heretical Kulá Ba-reng-gyí  
"(Foreigner-Feringi) deviated from the virtuous conduct becoming  
"a king. This Ku-la Ba-reng-gyí was the nephew of Peits-tsa-rit  
"Meng, and had been sent with seven ships and one hundred larger  
"vessels to attack Acheen. He took in guns, powder, and balls, at  
"Ma-li-ka (Malacca), but was defeated by the Acheen chief and  
"forced to retreat. He came to Muttama with a few vessels, and  
"was made prisoner by the governor, who sent him to Meng-ta-rá  
"Shwé-htí. The king soon became familiar with the youth, gave  
"him a house to live in, and bestowed upon him in marriage one of  
"the female attendants of the palace. This young woman, after  
"having learnt how to prepare dishes, according to the Kulá method,  
"was accustomed to present such eatables to the king. Not only that,  
"but wine and sweet intoxicating drinks, were also presented, of  
"which the king became very fond. At last the Kulá was wished to  
"live in the palace. From constantly drinking these liquors the  
"disposition of the king became changed from good to bad. He  
"gave contradictory and absurd orders. He attributed wrong motives  
"to innocent men, and ordered them to be put to death. At length

“Bhu-reng NOUNG with the concurrence of all the nobles, SHAN, Burman, and Talaing, took the guidance of affairs into his own hands, and putting the nephew of PEITS-TSA-RIT into a ship, with his property, and giving him gold and silver, sent him away to the KULÁ country.” From this time MENG-TA-RÁ SHWÉ-HTÍ had little more than nominal authority.

In the year 910, the father of BHURENG NOUNG who was king of TOUNG-Ú died. His title was MENG-RAI THI-HA-THÚ. He was succeeded by one of his younger sons, and there was bestowed on him the title of THI-HA-THÚ. He is also called MENG KHOUNG. Bhureng NOUNG having now become the virtual ruler, his descent is carefully traced in the history. On the father's side he was descended from MENG-KHOUNG-NGAI, who was governor of TOUNG-Ú, and was killed in the year 813. This MENG-KHOUNG-NGAI was the son, or younger brother, of TA-RA-BYA who had also been governor of TOUNG-Ú and who was of SHAN descent. Bhureng NOUNG's mother was said to be descended from a half brother of NGA-TSÍ-SHENG KYAU-TSWÁ, king of PÁN-YA. Bhureng NOUNG had two brothers, MENG-RAI-TSÍ-THÚ, who afterwards became king of MUTA-MA; and THA-DO-DHAM-MA, who became king of Prome. There were also two sisters. After their mother's death, their father had married her younger sister, and had two sons by that marriage, Bhureng MENG KHOUNG, who became king of TOUNG-Ú, and MENG-RAI KYAU-HTENG, called THA-DO-MENG-TSAU, who became king of Ava. The family was originally of SHAN descent. Having been settled for three or four generations at TOUNG-Ú, it had become Burmese in national feeling.

In the year 911, a son of BI-NGYA-RAN, the deposed king of Pegu by an inferior wife, rebelled, and took the title of THA-MEIN-HTAURÁ-MA. He got together a force, and took possession of the fort of MA-KAU. Bhureng-nOUNG-dau without delay took measures against him. He was defeated and fled, but managed to gain possession of the fort of THAN-LYENG (Syriam), and remained there secure. But he was soon obliged to abandon the place, when a force was brought against it, and fled to the westward. Bhureng NOUNG followed him up, and fixed his head quarters at DA-LA. At this time the tributary king of TOUNG-Ú, THI-HA-THÚ was in charge of the city of Pegu. A Talaing nobleman, THA-MEIN-TSAU-DWUT had been appointed go-

vernor of Tsit-toung (Sit-tang), but was now in charge of the palace and the royal person. The king Meng-ta-rá Shwé-htí was staying at a country palace, at a place called Pan-ta-rau. A report was spread of a white elephant having appeared, and the king was induced to go out into the jungal. Tha-mein-tsau-dwut now managed to send away those about the king on whom he could not depend, and at night in the month Ka-tshun 912 (May 1550, A. D.), he killed Meng-ta-rá Shwé-htí. He had reigned twenty years and was thirty-six years old. The chief Ra-hán performed his funeral rites, and collecting the bones, placed them in a golden vase, which he buried in an undefiled spot.

In the mean time, Tha-mein-tsau-dwut killed some of the nobles about the king; drew others to his side, and then withdrew to Tsit-toung, where he assumed the title of king. He took the title of Tha-mein-tsek-ka-wau. Bhureng Nong was at Da-la hunting down the followers of Tha-mein-htau-rá-ma in the difficult country of the delta. His younger half brother Thi-ha-thú called round him his followers, and marched from Pegu city to Toung-ú. Tha-mein-tsau-dwut at once occupied the city of Pegu. Tha-do-dham-má Rá-dzá, tributary king of Prome, changing his title to Tha-do-thú, declared himself independent. All the cities and districts at the Iráwati river beyond Prome as far as Pu-gán remained under their own governors. Bhureng Nong now consulted all the Shan, Talaing, and Burmese nobles who remained faithful to him. It was determined to march to Toung-ú as the place where Bhureng Nong could best collect his forces, and where he possessed most strength and influence. Whereas "Da-la in the midst of the Talaing country, was like a wasp's nest, into which the hand had better not be put." He immediately put himself in motion. His wife who was in the city of Pegu, managed to escape and joined him. When he arrived near Toung-ú, his brother Thi-ha-thú made no advances to him, but remained sullenly within the city. Bhureng Nong patiently waited in his camp watching events. At Pegu, the usurper Tha-mein-tsau-dwut did not long give satisfaction to the Talaing nobles. They therefore deposed him, and called in Tha-mein-htau-rá-ma who, by this time, had set himself up at Mut-ta-ma. These events induced several Shan chiefs, who did not wish to serve a Talaing king, to come with their

followers and join Bhureng NOUNG. Some chiefs also came to him from TOUNG-Ú. At length he found himself strong enough to attack that city. But he was obliged to proceed to reduce it by starvation. At the end of four months, the city was surrendered; no plundering was allowed; his brother was pardoned, and Bhureng NOUNG was consecrated as king, with the title of Tsheng-phyú-mýá-sheng Meng-ta-rá-gyí. His former title of Bhureng NOUNG will, however, be retained in this narrative.

The king now considered that his best plan was to make himself master of Prome, where another of his brothers was king. He marched his army across the hills from TOUNGÚ; but arrived on the banks of the IRÁWATI, he found himself at a loss for boats, while Tha-do-thú had a large fleet. The city was too strong to be attacked. The king therefore leaving it marched on to MYE-DAI, which submitted, as did MA-LWUN and other cities higher up the river. There he gained a large addition to his army and a fleet of boats. He therefore returned to Prome, and re-invested the city. Some of the officers in command were now in communication with Bhureng NOUNG, and the city gates were opened to him. The king pardoned his brother Tha-do-dham-ma-RÁ-DZA, and he was reinstated as tributary king of Prome.\* The whole country on the IRÁWATI, as far down as DHANÚ-BYÚ (Downebew), submitted to Bhureng NOUNG. It was now the year 913, and from the events which were occurring at Ava, the king of that city, Mo-byé-meng, had fled to take refuge. The king marched up the country, and penetrated nearly to Ava, which he intended to attack. But news reached him that preparations were being made to attack TOUNGÚ from Pegu. He lost not a moment, but marched back as far as MYE-DAI. From thence he despatched his brother Meng-rai-kyau-hteng with a force across the hills, and himself proceeded down to Prome. There he collected an army to invade Pegu, of which his brother Tha-do-dham-má RÁ-DZÁ was made commander-in-chief. He, however, marched to TOUNG-Ú, taking Mo-byé-meng with him.

\* The Ma-ha-RÁ-DZÁ-weng wishes to make it appear that Tha-do-thú who held out Prome against Bhureng NOUNG, was not his brother, but some one else who assumed the name. I have considered it most consistent with the whole narrative to assume that Tha-do-thú was the brother, and that like the other brother at TOUNGÚ, his rebellion was pardoned.

At Toun-g-ú, he made all arrangements to march against Pegu, and left in the month Ta-gú 913 (April 1551). His brothers Meng Khoung and Meng-rai-kyau-hteng accompanied him. He defeated the Talaing usurper, Tha-mein-htau-rá-ma, entered the city of Pegu, and the Talaing nobles submitted to him. The Talaing usurper, after taking refuge at Pu-thein, fled from that place to Mut-ta-ma, and became a Ra-hán. Bhureng Nong who had followed him to Pu-thein, then returned to Pegu city, where he built a house on the site where he had formerly lived. He now took measures for settling the country, and called his brothers around him. These were Meng Khoung, Tha-do-dham-má Rá-dza, Meng-rai-kyau-hteng, and Meng-rai Tsí-thú. He repaired all the pagodas and monasteries which had been injured during the troubles, and made suitable offerings at the grave of Meng-ta-rá-Shwé-htí. His brother, Meng-rai Tsí-thú, was now made tributary king of Mut-ta-ma, and received the regalia. Tha-do-dham-má Rá-dza received regalia as tributary king of Prome. Meng Khoung received regalia as tributary king of Toun-g-ú. He rewarded munificently all his officers, Burman, Talaing, and Shan, and the country and the people began to be quiet and satisfied. In Mut-ta-ma, however, though the Talaing usurper had become a Ra-hán, and fled to the border of Siam, he again appeared, collected a few followers, and proclaimed himself king. He was again defeated, and after wandering about in the jungles, was taken in the month Ta-gú 914 (April 1552). He was put to death.

Bhureng Nong now called a council to consider and decide upon his future measures. He was careful to assemble round him his brothers and principal officers, Burmese, Talaing, and Shan. The council was in favour of a march upon Ava, to establish there the government of Bhureng Nong. An army and flotilla were collected, which moved by water from Pegu in the month of Wa-tsho 915 (July 1553). The command of this force was given to Ma-há U-bá-Rá-dzá, the king's son, but on account of his youth an officer of experience was sent, who was really responsible. This expedition would appear to have been intended rather to reconnoitre than to attack. The king of Ava, styled Tsa-gaing Tsí-thú Kyau hteng, had made great preparations to defend his capital. An army of Shans, chiefly from the country to the east of the upper Iráwatí, was stationed

close to the city. Another army composed of the contingents of the western Shans and other troops, was encamped at Ta-ruk-myo on the bank of the Iráwati, about fifty miles below the capital. The invading army on reaching Pu-gán heard such reports of the defensive measures that had been adopted, that the commanders considered it prudent to report to the king the state of affairs, and await further orders. The result was, that the army under Ma-há U-ba-Rá-dzá retired.

Bhureng NOUNG now made more strenuous exertions. He collected men and provisions from all parts of the wide territory subject to him. In Pegu and Martaban a vast number of war-boats, and vessels of every description as transports, were constructed and collected. While this work went on, the city of Pegu was improved and a palace built. In the month Wa-tsho of the year 916, the son and nephew of the king of Arakan came, and took refuge with Bhureng NOUNG. He received them with great favour. The former he married to the daughter of his brother Meng-rai-tsi-thú, king of Muta-ma, and gave him the title of Thí-ri-dham-má-thau-ka. The latter, named Sheng-rai-myo, he married to one of his own daughters, and gave him the city of Ta-mau for his support.

The whole of the arrangements for the invasion of Ava were now complete. The strength of the army and flotilla is stated to have been as follows: The flotilla was to proceed up the river Iráwati. It consisted of six hundred large boats and war-boats; three hundred lighter row boats; and of five hundred provision boats; one hundred and twenty thousand soldiers accompanied the flotilla, of whom a portion was distributed on board the boats; while the rest apparently marched from point to point to keep company with the flotilla. The water force was under the command of the tributary king of Prome, Thado-dham-má Rá-dzá.

The land column of the army of invasion is stated to have consisted of one hundred and eighty thousand soldiers, with eight hundred elephants, and nine thousand horses. This included a corps of four hundred Ku-lá soldiers, wearing caps, uniforms, and trowsers, and armed with muskets. Their place in the line of march was in front and rear of the royal elephant. This army, under the immediate command of Bhureng NOUNG marched from the city of Pegu in

the month Nat-dau 916 (November 1554). The flotilla had been despatched much earlier.

The following arrangements were made for the government during the king's absence. His son Ma-há U-ba-Rá-dzá was left in charge at the capital city of Pegu, with a faithful officer as his adviser. At Mut-ta-ma (Martaban), king Meng-rai-tsí-thu remained with a large force, on account of the neighbouring kings of Zimmay and Siam. The governor of Mau-la-myaing, Bi-nya-ú, and other trustworthy officers were under this tributary king. Arrangements were also made towards the Pu-thein (Bassein) side to guard against any danger from Arakan.

Having thus provided for the safety of his southern kingdom, Bhureng NOUNG proceeded to carry out his plan for the subjugation of Ava. The whole army, other than that which accompanied the flotilla, marched direct north up the valley of the POUNG-LOUNG river to TOUNG-Ú. The main body under command of Bhureng NOUNG marching as far as RA-may-then, directed its march in a north-westerly direction, through KYOUK-PAN-DOUNG, until it debouched upon the IRÁWATI at PU-GÁN. The rest of his army continued its march northerly for some distance. A corps was then detached to the left under the command of the king's brother MENG-rai-kyau-hTEN, which went to attack the fortified post of PENG-ta-lai. The remainder under the command of the tributary king of TOUNG-Ú, MENG KHOUNG, continued its march direct towards Ava. After taking PENG-ta-lai, which made no resistance, MENG-rai-kyau-hTEN joined his brother, and they marched to a position somewhere in the neighbourhood of MYIN-TSAING or PÁN-YA, where they entrenched themselves, to await news of Bhureng NOUNG.

The king had so regulated his movements, that by the time he reached PU-GÁN, the flotilla and army which accompanied it, were not far off. He now crossed his whole army to the west banks of the IRÁWATI, landing at KWOM in the district of PA-KHÁN-GYÍ. The army then marched up the western bank of the river and up the course of the KHYEN-DWENG to A-MYÍN. A portion of the flotilla was also sent there, by which the army crossed that river. The governors of provinces everywhere submitted, and the king now marched to TSA-GAING. The governor of that city had fled to Mo-

nhyin. The king here disposed his whole army and flotilla, and sent scouts across the river to communicate with his brothers Meng-rai-kyau-hten and Meng Khoung, and to fix a day for a combined assault upon the city of Ava.

These arrangements having been agreed upon, the two brothers advanced from their entrenchments towards the city. The king of Ava, Tsi-thu-kyau-hteng, came out to oppose them at the head of a Shan army. A battle ensued, in which the Ava Shans were worsted, and forced back into the city. The two brothers then entrenched themselves on the ground they had won. In the mean time Bhureng NOUNG was crossing the Iráwati to the Ava side. Arrived there with his whole army, and in communication with his brothers, the city of Ava, the people, and the garrison were enclosed like fish in a trap. A general assault was made. The soldiers by attacking the gates, by digging and by scaling the walls, at length took the city in the month Ta-bu-dwai 916 (March 1555). The king of Ava, Tsi-thú-kyau-hteng, had escaped from the city, hoping to join the Un-boung Tsau-bwá, who was marching down with a force to support him. But he was taken prisoner and brought before Bhureng NOUNG. That great king having pity on him, at once provided for him a place where he might remain with his family and attendants. Afterwards he was sent to Pegu, and a handsome house suitable to his rank, with a pleasant garden, was provided for him at the city of Han-thá-wa-ti.

Bhureng NOUNG intending to remain for a time at Ava, built for himself a temporary house at TOUNG-ba-lú. His brother, Meng-rai-kyau-hten was made tributary king of Ava with the title of Tha-do-meng-tsau. He received the usual regalia. Bhureng NOUNG with the dignity of Emperor in the wide dominions over which he ruled, began such measures as were necessary to secure his victory.

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*Observations.*—The dynasties which reigned at Pu-gán throughout the long period of fourteen hundred years, had gradually declined from the powerful position which the monarchy held, during the reign of A-nau-ra-htá-tsau, in the eleventh century of the Christian era. The invasion by the Chinese, or Tartars, during the reign of Kublai Khan towards the end of the thirteenth century; the capture of the

capital, and the flight of the king to the southern provinces, completed the ruin of the kingdom. An immigration of Shans had long been going on—independently of the earlier arrival of people of that race in the upper Iráwati—into the country of the middle Iráwati. They had gradually acquired the influence due to their superior energy and intelligence. In the confusion which resulted from the destruction of the ancient monarchy, three brothers, leading men of Shan race, born in the country, who had risen to power under the native kings, gradually acquired independent authority. This authority probably did not extend in any direction over one hundred miles from Myin-tsaing as a centre. Before long, this Shan kingdom was separated into two states, one being established at Sagaing and one at Pán-ya. About fifty years later, these two states were absorbed, and a new dynasty was established at Ava in a position not far from the two former cities, by Meng-kyí-tswá, who professed to unite in his person, the claims of the three Shan brothers, and also of the ancient race of kings of Pu-gán. Ava indeed had been built in the year 1364 A. D. by Tha-do-meng-byá, who claimed to be descended from the ancient kings of Ta-goung; but he died without issue, and Meng-kyí-tswá was then called to the throne, as one who could rule in troublous times, and possessed what were acknowledged to be hereditary claims. While there seems to be no reason for doubting his descent from the sister of the three Shan brothers, his alleged direct descent from Kyau-tswá, the deposed king of Pu-gán, is probably an invention of aftertimes. However this may be, it is evident from the history that the whole power in the country which constituted the kingdom of Ava from A. D. 1364 until A. D. 1554, was held by Shans, or persons of Shan descent. The story of the finding of golden images by Meng-kyí-tswá at Meit-htí-lau, said to represent those who should reign in Burma of the race of the “Leng-dzeng kings of Siam,” shows that that king desired to be considered of Thai, rather than of Mrán-má or Burma race. The length of the reign of Meng-kyí-tswá, thirty-three years, enabled him to consolidate his power to some extent; to place a relative on the throne of Arakan, and to seek to extend his dominions by the conquest of Hantá-wa-ti or Pegu. The same object was striven after in the reign of his son Meng-khoung, and Pegu was invaded year after year, but

without success. The kings of Pegu at this time were no longer the old dynasty of Talaing race. The Shans from Zimmay and the adjoining states had occupied Martaban, and eventually succeeded to the throne of Pegu. These tribes of the Thai branch of the Indo-Chinese family, had been pouring down from their highlands by various routes through a long period of time. They gradually accomplished in the countries watered by the Iráwati and the lower Salwín, a plantation and revolution similar to what had been worked out by the north men, in the British islands, and on the coasts of Western Europe in the eighth and ninth centuries. Had it not been for the Muhammadan occupation of Bengal in the thirteenth century, it is probable that they would have penetrated into that country through Assam or Cachar.

The continued attacks made by the kings of Ava on Pegu, produced a counter invasion by Rá-dzá-di-rít, who nearly conquered Ava in the year 766, A. D. 1404. The possession of guns or jinjals at this time, with which Prome was defended, is mentioned; but it seems doubtful whether they can have been known in Burma at this period.

The successful attack on Ava in the year 788, A. D. 1426, by the Shan chief of Mo-nhyin, renewed the Shan race and spirit in the kings of Ava. But the monarchy was weakened. From this time for more than a century, the kings of Ava were rather the heads of a loose confederation of Shan chiefs, whose states lay to the north of Ava on either side of the Iráwati, than sovereigns of a Burmese kingdom. One curious result of this state of affairs was, that the rulers of the petty state of Toung-ú, originally Shan by race, gradually became identified with the national or Burmese party. This afterwards led to important results. The rulers of Toungú, more isolated from Shan influence than the Tsau-bwás to the north, became in fact Burmése. The character and conduct of the Shan chiefs, as disclosed in this history, entirely corresponds with the Tsau-bwás of the Shan country, of the present day. Each chief in his own state, which, in some instances, is but a few square miles in extent, is jealous of the least interference; and they have not yet learnt to combine for their general safety, except on sudden emergencies, when they rise in rebellion against the Burmese.

In the country of Toungú we have seen that the ruler Meng-kyí-nygo, who died in the year A. D. 1530, had reigned for forty-five years. During that period, while Ava was a prey to disorder, he had maintained his independence, and gradually increased his power. His son Meng-ta-rá Shwé-htí commenced his persevering attacks upon Pegu, overthrew that kingdom, and after a surprising career was assassinated at the early age of thirty-six years. It might have been anticipated, that here would have ended the fortune of the rulers of Toungú. But Bhureng NOUNG, the general of Shwé-htí, with wonderful enterprise, crushed all opponents, and combining the power of Toung-ú, of Pegu and of Prome, accomplished the designs of Shwé-htí by conquering Ava and the north. This he effected with a mixed army of Talaings, Burmese, and Shans; and though subduing the country where the Burmese people were probably more numerous than elsewhere, he claimed to represent the Burma race.

A future chapter will describe the remarkable career of this ruler; and the empire which he founded, extending from near the Burhamputra river to the Mekhong, or great river of Cambodia. The dealings both of Meng-ta-rá Shwé-htí and of Bhureng NOUNG with the Portuguese, who, with their Muhammadan followers, are styled Ba-reng-gyi and Pan-thé, the latter word apparently a corruption of Farsi, may also be illustrated from European sources.

*Memorandum.*—The accompanying lists, Nos. 1 and 2, contain the names of the kings of Burma, who reigned contemporaneously at Myintsaing, Pán-ya, and Tsagaing. The list No. 3 contains the names of the kings of Burma who reigned at Ava from the foundation of that city, until it was conquered by Bhureng NOUNG in the year 1555 A. D. The whole period of the reigns contained in the three lists, amounts to 257 years, or from A. D. 1298 to A. D. 1555. By the Burmese reckoning, as Ava was captured by Bhureng NOUNG in the month of March, before the current year 916 had been completed, there will appear by that reckoning one year less for the whole period than is shown according to the European Calendar.

No. 1.  
*List of Kings of Burma of Shan race who succeeded the Pu-gán Kings and reigned at Myin-tsaing and Pán-ya.*

No.	NAMES OF KINGS.	COMMENCEMENT OF REIGN.		LENGTH OF REIGN.	Relation-ship to preceding King.	REMARKS.
		Burmese era.	A. D.	Years.		
	A-theng-kha-yá, Rá-dzá-theng-gyan, Thí-ha-thú Ta-tsí-sheng, }	660	1298	14	...	Three brothers of Shan race, who usurped authority, and governed with equal power.
1	Thí-ha-thú Ta-tsí-sheng,	674	...	10	...	The youngest brother, reigned alone at Pán-ya.
2	U'-za-ná, ...	684	...	20	...	Son of Kyau-tswá, the deposed king of Pu-gán, adopted by No. 1.
3	Ngá-tsí-sheng Kyau-tswá,	704	...	8	Half brother.	Son of Thí-ha-thú Ta-tsi-Sheng.
4	Kyau-tswá, ...	712	...	9	Son.	
5	Na-ra-thú, ...	721	...	5	Brother.	
6	U'-za-ná byoung, ...	726	1364	3 m.	Brother.	Dethroned by Tha-do-meng-bya, A. D. 1364.

## No. 2.

*List of Kings of Shan race who reigned at Tsagaing contemporaneously with the Kings of Pán-ya.*

No.	NAMES OF KINGS.	COMMENCEMENT OF REIGN.		LENGTH OF REIGN.	Relation-ship to preceding King.	REMARKS.
		Burmese era.	A. D.			
1	A-theng-kha-yá Tsau Ywon, ...	677	1315	7	...	This prince was the son of Thi-ha-thú Ta-tsí-sheng, who reigned at Myin-tsaing and Pán-ya.
2	Ta-ra-bya-gyí, ...	684	...	14	...	Stepson of Thi-ha-thú Ta-tsí-sheng.
3	Shwé-doung-tet, ...	698	...	3	Son.	
4	Kya-tswá, ...	701	...	10	Son of No. 1.	
5	Nau-ra-htá Meng-rai, ...	711	...	7 months.	Brother.	This prince was driven from Tsagaing by an army of northern Shans and put to death by his stepson Tha-do-meng-bya in the year 726, = A. D. 1364.
6	Ta-ra-bya-ngai, ...	711	...	3	Brother.	
7	Meng byouk Thi-ha-pa-té, ...	714	...	12	Brother-in-law.	

No. 3.  
List of the Kings of Burma from the foundation of the City of Ava.

No.	NAMES OF KINGS.	COMMENCEMENT OF REIGN.		LENGTH OF REIGN.	Relation-ship to preceding King.	REMARKS.
		Burmese era.	A. D.	Years.		
1	Tha-do-meng bya, ...	726	1364	3	...	Founder of the City of Ava. This king, said to be descended from the ancient kings of Tagoun, was on his mother's side grandson of Atheng-kha-yá Tsau-ywon, the Shan king of Tsa-gaing.
2	Meng kyí Tswá Tsau-kai or Ta-ra-bya, ...	729	...	33	...	Elected to the throne as a descendant of the kings of Pu-gan, and of the family of the three Shan brothers.
3	Tsheng-phyú Sheng, Ta-ra-bya, ...	762	...	7 months.	Son.	
4	Pyin-tsing-meng-tswé, or Meng Khong, ...	763	...	21	Brother.	
5	Thí-ha-thú, Tsheng-phyú-Sheng,	784	...	4	Son.	
6	Meng-hla-ngai, ...	...	...	3 months.	Son.	
7	Ka-lé kyé-toung-nyo, ...	...	...	7 months.	...	
8	Mo-nhyin Meng-ta-rá or Meng-nan-tsí, ...	788	...	13	...	Usurper. A chief of Shan descent, who enforced his claim to the throne, as a descendant of the kings of Pú-gán, and of the family of the three Shan brothers.

## No. 3.—(Continued.)

No.	NAMES OF KINGS.	COMMENCEMENT OF REIGN.		LENGTH OF REIGN.	Relation-ship to preceding King.	REMARKS.
		Burmese era.	A. D.	Years.		
9	Meng-rai-kyau-tswá, ...	801	...	3	Son.	Killed by Tho-han-bwá who succeeded to the throne. Son of Tsa-lun, the Shan chief of Mo-nhyin, who conquered Ava. Shan chief of Un-boung, who was elected king. He was related to Shwé-nan Sheng. Abdicated.
10	Thí-ha-thú or Bhureng Na-ra-pa-tí, ...	804	...	26	Brother.	
11	Ma-há-thí-ha-thú-ra, ...	830	...	12	Son.	
12	Thí-ri-thu-dham-má Rá-dzá-dhi-pa-ti, or Duti-ya Meng Khoung, Má-há Rá-dzá, Dhi-pa-ti, or Shwé-nan-sheng, Nara-pa-ti ...	842	...	21	Son.	
13		863	...	25	Son.	
14	Tho-han-bwá, ...	888	...	16	...	
15	Khun-mhaing-ngai, ...	904	...	3	...	
16	Mo-byé-meng Na-ra-pa-ti, ...	907	...	6	Son.	
17	Tsa-gaing Tsi-thú-kyau-hteng Na-ra-pa-ti, ...	913	1551	3	...	A chief of Shan descent, who seized the throne. Conquered and deposed by Bhu-reng Nourng.

*The District of Lúdiána.*—By T. W. TOLBORT, Esq., C. S.

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The following article is one of a series which the contributor has written, or purposes to write, descriptive of different districts in the Panjáb. Most of the information it contains, has been derived from local sources. Much is legendary or trivial; but the writer in pursuing his own studies, has found the want in each district of a basis on which to commence historical or scientific inquiries; and it is to supply such a basis, however meagre or deficient in scholarship, that he proposes to publish the series of papers referred to.

Excluding topics of purely official or administrative interest, we shall find it convenient to arrange our account of the Lúdiána district under two headings. 1, Natural Features. 2, History and kindred topics.

#### 1.—NATURAL FEATURES.

The Lúdiána district is the most westerly of the three which form the Cis-Sutlej or Ambála division.

It is bounded by Ambála on the east, by Fírozpúr on the west, by Patiálá and other native territories on the south, and by the district of Jálandhar, from which it is separated by the river Satlaj on the north. The soil is sandy, yielding a rich crop of cereals and of grain, but is not so fertile for sugar cane and fruit trees, as in the neighbouring district of Jálandhar. The aspect and area of the district, have been much modified by a change in the course of the river Satlaj, which formerly flowed by the Lúdiána fort, but is now six miles to the westward. The old bank of the river forms a ridge the whole length of the district, and a small offshoot of the river called the Búddha Náláh still flows in the deserted bed. The Lúdiána district does not produce either mangoes or dates, but there is much to interest in its flora, and the writer regrets that he is not competent to give a detailed and accurate account of its botanical features. Some information on the subject may be found in a paper by Mr. Edgeworth, Vol. VII. of the Asiatic Society's Journal, page 751, and a short subsequent paper in Vol. XI., page 26. The Lúdiána district appears nearly to coincide with what Mr. Edgeworth in the papers referred to, terms the "phalahí" tract. The

principal trees are the kíkar, pípal, jand, sissú, sirras, mulberry, bher phalahi, tamarisk, baklair (bakáin, *Melia sempervirens*).

There are a few fine banyans scattered at intervals. There are a few jámans (*syzygium jambolanum*) at Lúdiána itself, but I have not seen any elsewhere in the district. At Máchiwára and at Bhilolpúr, in the north-east of the district, are a few impoverished mangoe trees, and there are some at Lúdiána itself, but they bear no fruit; in the neighbouring zillahs Jálandhar, Hoshiárpúr, and Ambála, they come to perfection. One of the most common trees in the belt or low land along the river, is called the pílkhan. Near Pakhowál is a remarkable grove of keham trees, respecting which the tradition is current that they can never be counted, no two visitors giving the same tale, although apparently the number is small. The bakáin is a well known tree of ready growth, but of no great ability for timber. It is a species of *Melia* (*sempervirens*), and consequently akin to the Ním, possessing some of the medical virtues for which the latter is so famed. Its leaves are long and pointed, like those of the Ním, and its fruits are about the size and shape of marbles. Akin to the bakáin, with similar fruit but with leaves somewhat broader, is the Dek, which I find in Forbes Watson under the botanical name of the Ním, though it appears to be a different species from the well known tree of Hindustan. Next to the irrepressible kíkar, the most characteristic tree in this district is the "reṛú," which I cannot find in Forbes Watson, but which Edgeworth describes hesitatingly as *Acacia leucophlœa*. Its foliage is darker than the common kíkar. It is common on the western, or Fírozpúr, side of the district, and is rare on the eastern side.

With regard to smaller shrubs and herbs, some make their appearance with the Kharíf after the autumn rains, and others with the Rabi', in spring, while many remain during the whole year. In the neighbourhood of Khanah, a nettle-like plant with large bright green leaves and white flowers, which covers all the lower hills, is common, but it is not found in those parts of the district from the Himalayas. It is called by the natives "basúta"; but this is a word used very generally and vaguely. While this plant is found only in the west of the district, the "karil" (*capparis decidua*?), so characteristic of the Multán desert, is confined to the eastern half, becoming more com-

mon as the Fírozpúr boundary is approached, but nowhere so abundant as in the Multán division. In the neighbourhood of Máchiwára, I have noticed numerous clusters of a shrub 5 or 6 feet high, called "Samálú." It seems always to grow in such clusters, forming a natural kind of hedge or coppice; I have not seen detached shrubs. The leaves are in triplets with two smaller below. They are long and narrow at both ends, darker above and whitish beneath. I believe, this is the *Vilex trifolia*.

But the three shrubs abovenamed, are not in any sense characteristic of the district. Much more common are the following. The bher, a species of *Zizyphus* or jujube, is almost as general as the kíkar tree. Many parts of the country are covered with a smaller shrub like the bher, and I presume also a species of *Zizyphus*. This is called "jhári." Its small leaves, mixed with white *bhúsa*, are given as food to oxen. Of course the omnipresent "ák" or "madar" is found in abundance here as everywhere else. Royle has devoted two or three pages of his book on the fibrous plants of India to the economical uses of this plant, *Calotropis gigantea* and *Hamiltonii*. So far as this district is concerned, I believe the only use made of it is to apply the milky juice externally to stings or parts suffering from rheumatism. Its soft but pungent down makes an admirable stuffing for pillow-cases.

Besides the Ak, there are three weeds, which deserve separate mention from their abundance. First the "chúris roz." This shoots up during the autumn rains in every field. In the winter, the stalk becomes dry, contrasting in colour with the small tuft of canes at its base. At this time, the flower spike, when rubbed, gives out a very pleasing cinnamon-like scent. This, no doubt, is a species of *Andropogon*. Another troublesome weed goes by the name of "piyází," on account of its resemblance to the onion. The leaves and stalk are like those of an onion, but it has no smell, nor does it seem to produce a bulb. The flowers which grow in a spike, are small and pretty, bell-shaped, white in colour with light brown stripes. This weed is a constant intruder in the corn fields.

There is a third very common leguminous weed, which seems to bear several names, among which are "máhá" and "malúla." It looks like a wild vetch. Between Samrálá and Máchiwára, and

also in many other parts of the district, the ground is covered with it. It is used as fuel by the gram roasters. The “ákás bel” or dodder, *cuscula reflexa*, which is common on the Jálándhar side of the river, looking very pretty as it covers the hedge-rows with a yellow, silk-like net, is also found here, but is not so common. The cactus which makes the favourite hedgerow in the Jálándhar Duáb, does not come to perfection here. “Aliya” and “henna” succeed better.

I may add to my list of common weeds easy of identification, the “itsit” (*trianthema pentandra*), a creeping plant which spreads over the ground; the “bhakhra” or “gokrá” (*pedalium murex*) also recumbent, the fruit of which is used by the natives for gonorrhœa, the “hulhul” (*cleome viscosa*?) of which the seeds possess anthelmintic and other virtues, and the “pápra” or “sháhbra,” which is used for cutaneous diseases and is, I believe, the “*Fumaria officinalis*,” or fumitory.

Of course this is by no means an exhaustive list of the Lúdiána flora. There are many plants that I know by their native, but not by their scientific names; and doubtless there are many more which have not come under my observation at all. The garden plants are the same as those cultivated elsewhere in the Panjáb and North-West.

## 2.—HISTORY.

Doubtless the province of Sarhind, through which the classical Saraswatí flowed, and which was the scene of so many struggles for empire in Muhammadan times, possessed historical interest from the very dawn of Brahmanical religion; yet the traces of ante-Musalmán civilization are few. There are extensive ruins of undoubted antiquity at a small village called Sunet, about four miles from Lúdiána on the Fírozpúr road. The settlement report speaks of it as an old Rájpút city, said to have been renowned throughout Hindustan for its size and splendour. Coins and large old bricks with figures on them, are constantly dug up from its remains.

The most common impression on the bricks is that of three or four fingers of the human hand. There are no standing ruins; but broken bricks are found on the surface for a great distance, and excavations beneath what are now corn fields, uncover walls and floors of brick

so extensive, that for centuries past they have supplied Lúdiána with much of its building material. People say, that the masonry work is mostly upside down, the smooth and marked side of the bricks which one would expect to find uppermost, being on the contrary downwards. This may perhaps indicate that Sunet was overthrown by some sudden convulsion of nature, perchance an earthquake, and the popular traditions are in accordance with this supposition. I have been unable to trace the authentic history of Sunet, but the story of its fall, a mixture of Hindú and Muhammadan fable is as follows: There was once a king at Sunet, named Rájá Mauj Gend or Panwár, who treated his subjects with great violence and cruelty. This king was afflicted with an ulcer, and was told that human flesh would do it good. So an order went forth to bring him a human being, as occasion required, from each household.

One day it so happened, that it was the turn of a brahman widow, who had an only child, ten years of age. The myrmidons of the tyrant came to carry off the child, when its mother's tears moved the sympathy of a holy man, Sháh Quṭb, by name. He, after a vain attempt to turn away the soldiers, swore that they should never see their homes again, and so it happened. They turned towards Sunet, but both Sunet and its rájá had disappeared from the face of the earth.

Next to Sūnet, the town of most undoubted antiquity is Máchíwára. There is a local tradition that a woman named Machodrí, the grandmother of the Pándavas, founded it. I do not find any mention of Machodrí in Talboys Wheeler's book. The paternal grandmother of the Pándavas was a daughter of the Rájá of Kási. Of the maternal grandmother nothing is said. The mother bore the name of Mádrí. Of her, Talboys Wheeler writes—

“Mádra is the ancient name for Bhootan, and there seems some reason for believing that Mádrí belonged to one of the mountain tribes occupying the southern slopes of the Himálayas, but probably much further to the westward than the country of Bhootan.” This is not inconsistent with the story that Máchíwára may have been founded by some ancestor of the Pándavas; but these myths are too vague and various to be of any historical use.

Another tradition connects the name Máchíwára with that of some Rájá Machhandar. It is much more probable that the word simply means "the fisherman's village," *máchkí* being the word for *fish*. There are several other villages on the Satlaj and on other rivers, bearing names either identical or nearly so. Whether we adopt a simple or a far-fetched etymology, the antiquity of Máchíwára is undisputed. Besides Sunet and Máchíwára, there is reason to believe that a third town, Tihára, was of importance in pre-Islamic times.

But if the etymology given by Edgeworth be correct, the name Tihára will appear comparatively modern, being used to denote the low land by the river, which paid one-third of the produce as revenue while the "Chauhára" tract only paid a quarter, and the "Pachdie" two-fifths.

The settlement report states: "There are traces of the town having become a ruin previous to the general Muhammadan invasion of India, in consequence of the internal feuds either of the Rájputs or of some other Hindu race with theirs."

The settlement report refers to some Rájá Biroyt as governor of Tihára about the time of Rái Pithora, when Shiháb-uddín Ghorí invaded India; and to a Rájá Shání, a Gaisí Rájput as ruler of Bhilolpúr; but the dominant tribe of Rájputs in the neighbourhood of Sunet seems to have been the "Punwárs."

Alexander never touched the Lúdiána district. His encampment on the Hyphasis or Satlaj was probably below its junction with the Beyás opposite Fírozpúr, and as no special mention is made of any important nation on the left bank of the Satlaj, we may presume that the Lúdiána district was included in those *vastæ solitudines* which arrested the Macedonian's progress.

The history of the district in Muhammadan times is, as might have been expected, much more detailed and authentic. It was a portion of the province of Sarhind, which was ever the battle ground of Muhammadan India. But to give a detailed history of the province is not our object, we merely select special allusions to the district itself.

For many years after the invasion of Taimúr, the banks of the Satlaj appear to have been the scene of a succession of struggles with various lawless tribes. First, we find mention of Turks under Malik Toghán, then of an impostor who appeared near Máchíwára,

and falsely gave himself out as Sárang Khán, the deceased viceroy of Multán, lastly of the Gakkhars under a famous chief named Jasrat. The city of Lúdiána owes its origin and name to the Lodís, and its early history is thus given in a local account. The country was overrun by Beloches (?). The cultivators represented the matter to the emperor Sikandar Lodí, who sent two generals, Yúsuf Khán and Nihang Khán, also Lodís, to punish the marauders. They encamped near the site of the present fort where, in those days, there was a village called Marhotá. Having driven out the Beloches, they heard that the Gakkhars were plundering on the north side of the river. So Yúsuf Khán crossed the river, subdued the Gakkhars, and founded the city of Sultánpúr (now in Kapurthalla territory), where he settled. Meanwhile Nihang Khán remained at Marhotá, to which he gave the name Lúdiána. He was followed by his son Mahmúd Khán, and the latter by Jalál Khán, who built the first Lúdiána fort with Sunet bricks. Jalál Khán had two sons, Haibat Khán and Táhír Khán. The latter died without offspring, the former left two sons Alú Khán and Khiḍr Khán. It was in their time that Bábar overthrew the Lodí dynasty of Delhi. Members of the Lodí family continued to reside at Lúdiána and Bhilolpúr after the downfall of their empire; but there is a tradition that they were massacred in Akbar's time; at any rate no descendants of the family are now to be found. Their tombs and other buildings, which were once a prominent feature near the fort and perhaps in the direction of the European residences, are now levelled with the ground.

In the beginning of 1555, a great battle was fought at Máchíwára, doubtless the town so called in the Lúdiána district. The battle is thus described by Farishta.

“Sikandar Sháh Súr in the meantime had ordered Tátár Khán and Habíb Khán with an army of thirty or forty thousand horse, from Dehli against Humáyún. Notwithstanding the great superiority in number of this force, Bairám Khán Turkmán resolved to hazard an action, and having advanced boldly to meet the Indian army, pitched his camp on the banks of the Satlaj at the town of Máchíwára. It being cold weather, the Indian Afgháns kindled great fires of wood in their camp at night, of which Bairám Khán took advantage, and crossed the river with a thousand chosen horse. He now advanced to their

camp without being discovered, when he began to to gall those who crowded round the fires with arrows, which threw them into disorder. The Afgháns (notorious for blundering), instead of extinguishing their fires, which prevented them from seeing their enemies, who had a fair view of them, threw on more wood; and the whole of Bairám Khán's army having crossed the river, fell upon them on all sides, and routed them. The Afgháns, on this occasion, lost all their elephants, their baggage, and a number of horses. Bairám Khán sent the elephants to Humáyún at Láhor, and remaining encamped at Máchíwára, he dispersed detachments in all directions, and occupied all the country up to the walls of Dihlí. The king was greatly rejoiced, when he heard of this victory, and conferred on Bairám Khán the title of Khán Khánán."

In the *Aín i Akbarí*, three mahals are named, which are still included in the modern district. They are, Lúdiána itself with a revenue of 2,294,933 dāms; Tihára, 7,850,809 dāms; and Máchíwára, 653,552 dāms. Each of these is described as having a brick fort. The dām in Akbar's time was the fortieth part of a rupee.

During the supremacy of the Moguls, Lúdiána is seldom mentioned in history, but before referring to subsequent events, we will give a short account of a distinguished Rájput family known as the Ráis, who have at times been more or less influential in this neighbourhood. The account is furnished by one of themselves.

About the year 1308, Sumbat, there was a Rájá of Jaisalmír and Bhatnír, named Dulchí Rám or Bersí. His ancestor, Rájá Mokal, had built a fort called after himself, where Farídkot now is. Mokal's servants inadvertently seized the famous saint Faríd-uddín Shakarganj, whose shrine is still at Pák Pallan, and compelled him to labour. On discovering the saintly character and miraculous powers of his workman, Rájá Mokal called the city by his name, Farídkot. Dulchí Rám had a son, Tulsí Dás, who came in the direction of the Panjáb, to see Farídkot. At that time Sayyid Makhdúm Jaháníyán resided at Jaisalmír, and through his influence Tulsí Dás embraced Islám, and assumed the name of Shaikh Cháchú. So Shaikh Cháchú came as far as Hattúr, and colonised a village in the neighbourhood, called Chakar. Hattúr itself had been founded by a certain Rájá, Jagdeo Sing, and his descendant was at first hostile to the new-

comers, till mollified by Shaikh Cháchú, who subsequently took advantage of his presence at a wedding to murder him. Shaikh Cháchú then took possession of Hattúr. He had two sons, Pahrú and Nopál. The former remained in Hattúr, where an *'idgáh*, built by him, is still standing, while Nopál founded the village of Sháhjahánpúr, near Ráikot. Pahrú had two sons Rai Dalla and Rai Jaggú. They rented from 'Alá-uddín Ghorí (Khiljí?) the pergunahs of Tihára, &c., and received the title of Rái Raián. At that time, their possession extended from Fírozpúr to Máchíwára, and, as their descendants are fond of saying, comprised 1360 villages. They also acquired some villages on the other side of the Satlaj. Among these was one named Dalla (after the founder Rai Dalla), near Sultánpúr in Kapúrthalla. The village still bears his name. Rái Dalla had a son Rái Kamál-uddín, who received the title Sultán for his military services in the south.

To enumerate all the branches of the Ráis would be a minute and profitless task. Many of the towns and villages in the Lúdiána district were founded or re-founded by them; some still bear names of individual members of the family; and others, as for instance Jagráon, Ráikot, and Talwandi Rái, have incorporated the word Rái itself. It is also said that many members of the family settled in other parts of India, even as far as Patna on the one side and the province of Gujrát on the other. One Rái Kulla colonised Talwandi Rái in Sambat 1535. About Sambat 1600, another member of the family Fath Khán rebuilt Bassián, which had been in ruins before, and which went to ruin again after his death. A second Rái Kulla built Ráikot in Sambat 1643. Jagráon, at present the second commercial city in the district, was founded by another member of the family Kamál-uddín 1125, Hijrí. There are different derivations of the name Jagráon; some say that it means Jagah Raián, the place of the Ráis; but the more probable explanation is, that "Jag" was the name of a Rájpút who preceded the Ráis, and that the two names are united in the word Jagráon. Omitting minute and unimportant family details, we come to Rái Kulla who, in Sambat 1743, threw off his allegiance to the emperor of Dihlí. 'Alí Muhammad Rohílá, governor of Sarhind, reduced him to submission for a time, but was then called off by the inroads of the Sikhs, and Rái Kulla established his independence. He died in Sambat 1826.

His son and successor, Rái Muhammad, died in S. 1850, leaving the inheritance in the hands of a child, Rái Ilyás. The Sikhs took advantage of his tender age, to appropriate Dharmkot and other portions of his dominions. In S. 1856, Bábá Sáhib Sing Bedi of Una in the Hoshyarpúr district, and others pressing him hard, Rái Ilyás hired the assistance of the adventurer George Thomas, then ruler of Hānsí, and known here as "Járj Sáhib." Thomas got a lákh of rupees for his services, and with his assistance the Sikhs were driven across the Satlaj. Three years after this, young Ilyás was out hunting in the bír, half way between Jagráon and Sidhúwan. He was holding a drawn sword, when suddenly his horse reared with him. He fell and ran the sword into his thigh, inflicting a mortal wound. His mother Rání Núr-unnisá then became chief of the Ráis; but in S. 1863 and S. 1864, corresponding to A. D. 1806, and 1807, Ranjít Singh overran most of her dominions, leaving her only Ráikot itself. In A. D. 1831, Núr-unnisá died, and was succeeded by another lady, Rání Bagbarí, widow of Ilyás. On her death, Ráikot lapsed to the British Government.

We now return to the general history of the district. The invading armies of Nádír Sháh, Ahmad Sháh Durání, and the Mahrattas, must have frequently crossed the district, but have left few traces behind them. A local history states that Nádír Sháh, on some complaint being made, ordered a general massacre in Lúdiána. I am unable to say whether this is true or is merely a local version of the Delhi massacre. Ahmad Sháh Durání gave Máchíwára and other portions of the district to Bhíkam Khán, Nawáb of Maler Kotla. The Maler Kotla family who are still sovereign princes, claim descent from a faqír, Hazrat Shaikh Sadr Jahán, disciple of Bahá-ul Haq, and this faqír is said to have been he who sold the empire of Delhi for 2000 dínárs to Bahlol Lodí.

The struggle for supremacy, between Sikh and Musalmán during the latter half of the eighteenth century was much more important in its permanent results than these invasions from Kábul, and it is much fresher in the memory of the people. This neighbourhood is classic ground in Sikh history. Máchíwára and Bhilolpúr were the scene of Guru Govind Singh's adventures and persecutions (see Macgregor's History, chapter V., pages 88 and 94), and Sarhind,

even in its desolation, is to every Sikh an accursed spot, as the city where the Guru's two sons were murdered. In 1762, a great battle was fought about twenty miles south of Lúdiána between Ahmad Sháh and the Sikhs, a battle in which the Sikhs were defeated with great slaughter, and which they still remember by the name of "Ghulú Ghára" (Cunningham's *History of the Sikhs*, pages 100-101). But in the following year the Sikhs gained as great a victory, sacked and destroyed Sarhind, and established their supremacy throughout the province. The Sodhis established themselves at Máchíwára; the Jágádrí, Jhínd, Nábah, and Patiálá chiefs in the south, and the Alhúwálía family at Jagraón. Lúdiána itself was occupied for a time by Hindú Rájpúts of the Halwára got. They were expelled and succeeded by the Ráis under Rái Kulla. During the rule of his successor, Rái Muhammad, in S. 1822, Nattu and Chúhar, his representatives in Lúdiána, repaired the fort, each mahalla of the city building a portion. For some years, they kept off the Sikhs by payment of black mail, but the neighbourhood was laid waste. When the plundering expeditions of the Sikhs were announced, a drum was sounded to give warning, and the people took refuge in the fort. The city was plundered over and over again, by Bhág Sing Bheriya, by the sardárs of Khánah, by Karm Singh Narmalla of Sháhábád, by Bhangá Sing of Thánesar, and others. On the death of Rái Muhammad and the accession of the child Rái Ilyás, the encroachments of the Sikhs became greater; but the thánahdár of the Ráis at Lúdiána, whose name was Husain, defended the city with great bravery. It was then that Bedí Sáhíab Sing, already referred to, invaded the territory of the Ráis. He penetrated as far as Maler Kotla, destroying Maler itself, and profaning the shrine of Shaikh Jí. Most of the Jat zamindárs fraternised with him. At last, one night, the citizens of Lúdiána admitted the Bedí, while the Ráis retreated to the fort. Then it was that the Ráis applied to George Thomas, and by his assistance expelled the Bedí. To oppose Thomas, Lál Sing of Kaital and Bhág Sing of Jhínd applied to Perron, the well known French general in the Mahratta service. He sent a subordinate, whom the local history calls Loí Sáhíab (probably Louis Bourquin), who defeated Thomas. But the Ráis found means to appease the conqueror, and were allowed to retain their dominions on pay-

ment of a nazrána. On the death of Rái Ilyás, his mother Núr-unnisá appointed two Gujars, Ahmad and Madahí, as her deputies. They rebelled, and took possession of Lúdiána and Jagráon for themselves. Nur-unnisá was obliged to re-engage the brave and faithful thánahdar Husain. The rebels applied for assistance to Bhanga Sing of Thanesar, who was glad of the opportunity for interference. There were numerous battles. Husain valiantly protected his mistress against the rebels, Ahmad and Madahí, who were shut up in the fort, on the one hand and against Bhanga Sing on the other. Bhanga Sing was wounded, and was nearly defeated, when unhappily Husain was slain. His followers lost heart, the Rání fled to Ráikot, and the people of the city deserted their property and their homes. Bhanga Sing remained eleven days, plundering and laying waste the city, burning all that was consumable. This was in Sambat 1860. So Ahmad and Madahí remained masters of Lúdiána and Jagráon till 1862, when Ranjít Sing overran the country, and gave the city to Bhág Sing of Jhínd. In S. 1864, or A. D. 1809, Sir David Ochterlony came here, and repaired and occupied the fort; but the city and cantonment site remained with the Jhínd family till the death of Sangal Sing, when they escheated to the British Government, in A. D. 1835. While these events were taking place at Lúdiána itself, numerous Sikh sardárs had established themselves in various parts of the district, where their descendants still hold jágírs. The most important of these families is that of Maland, a branch of the Phúlkia clan, and consequently related to the rájás of Patialá. Their ancestors appear to have lived for some time at Sahnah, a town in the extreme south of the district which still belongs to their jágír. In A. D. 1762, Mán Sing took possession of Maland, which has since given its name to the family. His son Dalel Sing was the most distinguished of the sardárs. His tomb is a prominent building at Maland. The jágír has been since divided into three. The other Sikh jágírdárs in the district all trace their origin to the general appropriation made by the Sikh army after its great and final victory over the Musalmáns, when Sarhind was destroyed.

We have now brought the history of the district down to the time, when it merges in that of British India. Some memorable events have occurred of later years; but it is not our work to narrate them

The battle field of Aliwál is in the district, and during the mutiny a skirmish took place here with the Jálandhar mutineers (see Cave Browne's "Panjab and Delhi," pages 251 to 264.

An account of the Lúdiána district would not be complete without reference to the new sect of Sikhs, the Kúkas, who have lately made some noise in the Panjáb. Their founder, Rám Sing, is the son of a carpenter, named Jassa Sing, and lives at Bhainí, a small village some 15 miles to the east of Lúdiána. He is over 50 years of age, is married, and has had two daughters married, to one of whom further reference will be made. He served in the Khálsa army between 1844 and 1846. There is a story that, in 1850, Rám Sing was engaged in the shop of one Panjába, at that time a well known carpenter of Lúdiána, and embezzled a large sum of money belonging to his employer. With the capital so obtained, he started a shop at Bhainí in partnership with some one else who, after a time, served Rám Sing the same trick that the latter had played Panjába. After this, Rám Sing left for the Ráwal Pindí district, and there became the disciple of an Udási faqír, named Bálak Sing.

From him Rám Sing received the religious impulse which has since influenced his career. Bálak Sing himself was but little known, and has been dead for 8 or 9 years. Rám Sing began to proselytize about 1858, and assumed the title of Bhái in 1860.

Rám Sing, like most other reformers, repudiates the character of innovater, and professes to be merely a restorer of the old religion. He is a purist Sikh, acknowledges and reveres the ten gurus, and the granths, and preaches the unity of God. He differs from the orthodox Sikhs chiefly by a more stringent enforcement of morality, and by his iconoclastic tendencies, condemning the erection of tombs and shrines. Notwithstanding these tendencies, he is constantly visiting the sacred cities of the Sikhs, Amritsar, Mukatsar, and Anandpúr Makkowál. Like other Sikhs, the Kúkas wear the "kes" or long hair, and are initiated by the sacrament "páúl." Rám Sing condemns excessive lamentation for the dead as being distrustful of the Deity. He particularly warns his disciples against foolish extravagance in their marriage expenses. He teaches them to believe in "heaven" and "hell." A disciple and namesake of Rám Sing gave me the following list of virtues especially inculcated by his guru—fear of God, faithfulness,

purity and cleanliness, truthfulness, benevolence, consciousness of the Deity's presence, compassion, abstinence from covetousness, abstinence from perjury. Particular stress is laid on truthfulness, and it will, I think, be admitted that as a class, the Kúkas are remarkable in this respect. On initiation, a sentence or "mantra" is whispered into the ear of the convert, which he is told to repeat constantly to himself, but never to divulge. The Kúkas have frequent religious meetings. They sit round a large fire, one reads the granth, and others repeat favourite slokas. This continues till many work themselves into a state of great excitement, and it is, I presume, from the cries they then utter, that the name Kúkah or "Howler" has been given. Many of the common slokas or sayings among the Kúkas have an iconoclastic purport. Thus—

Pahilá máro Pír Bannoí  
 Phir máro Sultána  
 "First destroy Pír Bannoí  
 "Then destroy Sultána."

Pír Bannoí is a saint, whose shrine is in the state of Patialá, while the Sultán referred to, is the famed Sakkí Sarwar, whose shrine is in the district of Dera Gházi Khán. Kúkas may be recognised by the unusual whiteness and cleanliness of their garments, and by a very large and prominent turban. They often carry a small club or hatchet, and also a small blunt knife. There is a proverb applied to Sikhs generally that they have four *Ks*—Karád, Kes, Kangá, Kachh, *viz.* a knife, long hair, a comb, and short-drawers. The total number of Kúkas has been estimated at 60,000. Converts are chiefly made among Jats, Tirkháns, Chumárs and Mazbís, besides a few Muhammadans. Rám Sing has appointed from twenty to thirty apostles under the title of Súbahs. Of these, Sáhíib Sing is the chief, and he, it is supposed, will succeed Rám Sing. For a time, Rám Sing was kept under surveillance by Government, and this rather added to his *éclat*. For two years past, he has been at liberty to go where he chooses. He has attended the great Sikh festivals, but has been rejected by the orthodox guardians of the temple. On the occasion of his visit to Anandpúr Mákkowál in 1867, a riot was with difficulty avoided. During the last twelve months there has been an undoubted diminution of enthusiasm and deterioration of morals among the new

sect. Scandals have arisen, culminating in the murder of Rám Sing's own daughter by her husband, it is supposed, on suspicion of unchastity. But the sect is still of importance; the disciples regard Rám Sing as the incarnation of the deity, as the same being who animated in succession the ten preceding gurus. A very worthy Kúka known to the writer, expressed himself as confident that this was the case because of the wonderful and ecstatic thrill which pervaded the disciple, when he heard the sacred "mantra" from his teacher's lips.

We now proceed to give a short account of the prevalent local castes and a few phrases exemplifying the local dialect.

Out of a total of 879 villages, 532 belong to Hindú Jats; 76 to Muhammadan Jats, 98 to Muhammadan Rájpúts, 87 to Gujars, and 42 to Raians. The statistics of the more important Gots are as follows: among Hindu Jats,—Gil 97 villages, Dhálúvál 95, Sandhú 82, Garewál 55, Punaich 41, Upal 22. Among the Muhammadan Jats—Kúrsá 27 villages, Túr 10, Molíwvál 9. Among the Rájpúts—Manj 52 villages, Ghorewál 13. Among the Raians—Karu 22 villages, Rahíl 12, Narú 10. These constitute the agricultural population. Here, as to the west of the Satlaj, the Khattrís are the great commercial class. Their principal gots are Chirímunj, Nande Khullar, Jerath at Lúdiána itself; Bahl, Kapúr, Mahre, Seth, Berí, Senchar, and Dhír at Jagráon; Batte, Sohndí and Karír at Máchíwára, and Bahlolpúr; Sahgal and Thápar at Ráikot; Haḍ and Cham at Khanah. But the gots of Khattrís are innumerable. There are a great many bánias of the gots Gar, Goyal, Sítal, Mítal, Eran, Dheran, Básal, and Kásal. The brahmins are mostly engaged in retail trade, and are not influential. Leaving out of view a few Roras and other castes, the two most important commercial castes remaining to be noted are the "Súds" and the "Bhábras." As they have not been described in Campbell's ethnological sketch, our readers may be interested in a short account of them.

The caste Bhábra is of the Jain sect, and except a few bánias here and there, I have not heard of any "Jains" in the Panjab other than these "Bhábras." The following account is by one of themselves.

About eleven hundred years ago, there was a holy man at Osanagarí in the country of Gujrát. His name was Rattan Deo. He changed

the name of the inhabitants from Rájput (?) to Oswál. The Bhábras were originally Oswáls, and the name Bhábhra is peculiar to the Panjab. At Dihlí, the Oswáls generally go by the name Jauharí, because they are generally employed as jewellers. The name Bhábhra was originally Bháo Bhale, or "good brother." The peculiarities of the Jain religion need not be detailed here. Abstinence from all animal food, and an excessive regard for animal life are its most remarkable tenets.

The "Súd" caste is very different from the Bhábhra, though both are money-lending. Súdś like the Káithś of Bengal are lax in matters of eating and drinking. They are much less religious than Khattrís, and they have a very bad name for dishonesty. Perhaps most judicial officers in this neighbourhood will admit that of all classes the Súdś and the Zargars, or goldsmiths, are the most given to cheating. The chief gots among the Súdś are Raskí, Mihán, Kulle, Shahí, Dosáhj.

Among the Káshmirí residents of Lúdiána, besides ordinary Muhamadan caste names, there are three principal castes or gots, Baṭ, Bánḍe, and Gámaní.

In order to exemplify the local dialect, I will first render in it the sentences given by Mr. Campbell at the end of his appendix A, and will then add a list of a few local words which have struck me as peculiar.

What is your name?

Tera kí náún hai?

How old is this horse?

Es ghore dí kí 'umr hai?

The price of that is two rupees and a half.

Ohda mul ḡháí rupaiyá hai.

My father lives in that small house.

Merá pyú os chhoṭe koṭhe vich rahnda hai.

Give this rupee to him.

Ih rupaiyá oh nú dih.

Take those rupees from him.

Oh rupaiye oh toṇ le le.

Beat him well and bind him with ropes.

Oh nú khúb már ate rassi nál ban de.

Draw water from the well.  
 Kúe vichon pání kaḍ le.  
 Walk before me.  
 Mere sáhmne chalo.  
 Whose boy comes behind you ?  
 Kis dá muṇḍá tere magar aunda hai ?  
 From whom did you buy that ?  
 Taiṇ oh nu kithon mul liyá ?  
 From a shop-keeper of the village.  
 Pind de haṭwánía kolon.  
 How far is it from here to Kashmir ?  
 E ton Kashmir nú kinní dúr hai ?  
 How many sons are there in your father's house ?  
 Tere pyú de ghar kínne puttār haiṇ ?  
 I have walked a long way to-day.  
 Aj main dúr te sail kítí hai.  
 The son of my uncle is married to her sister.  
 Mere cháche dá puttār ohdí bahn nál vyáhá hoyá hai.  
 In the house is the saddle of the white horse.  
 Chittí ghore dí káthí ghar vich hai.  
 Put the saddle upon his back.  
 Káthí ohdí piṭh utte kas de.  
 I have beaten his son with many stripes.  
 Main ohde puttār nú bahut már mári.  
 He is grazing cattle on the top of the hill.  
 Oh pahár utte dangar charándá hai.  
 He is sitting on a horse under that tree.  
 Oh os darakht heṭán ghore te baiṭhá hai.  
 His brother is taller than his sister.  
 Ohdá bhará ohdí bahn nálon waḍḍa hai.

*Local words and phrases.*

mallomallí	by violence.
berwá	details.
siṭh dená	to throw.
aujaṛ jáná	to lose one's way.
tiḥ	a mound of ruins.

kamlá	blockhead.
aukhá	difficult.
nívín	low, not elevated.
barkhá	rain.
uprant	in future.
úrlí pásí	on this side.
parlí pásí	on that side.
aidkí	this year.
paron	last or next year.
parár	year before last.
mohándra	face, appearance.
kup	stack (of <i>bhúsa</i> , &c.).
baṭa saṭa	exchange, barter.
lahndá	west.
chharda	east.
pahár	north.
sarmailí	south.
chakan	to lift up.
gohára	heap of manure.
sajjá	right.
khabbá	left.
wahra	a young bullock.
tagádá	jewels, &c.
biḍh	watercourse of a well.
áwah	brick kiln.
ṭair	a lean mare.
gaṭhná	to mend.
rojh	níl gáo.
mainh	buffalo.

Religious fairs and pilgrimages are of such interest to the people of this country, that they call for a description notwithstanding the absurdities connected with them. There are two great bathing-fairs held here, the “bhet chandas” and the “baisákhí.” And immense concourse of people meet at Lúdiána on the 11th Rabí’ ussání to celebrate a festival called the “Roshaní.” This is in honour of one of the greatest saints in Muhammadan tradition, Shaikh ’Abdul Qádir i Jílání, who is spoken of as Pír Sáhíb or Pírán i pír. Herklots in

his translation of the Qánún i Islám devotes one chapter to this saint under the name of Pír i Dastgír (pages 237 to 241). This saint, who is esteemed by educated Muhammadans the chief among Walís, was born in the year 471 H. in Jílán (Gílán). During thirty-three years, he prepared himself for the dignity of walí. He died in 561 A. H., being then 90 years of age, and was buried at Bagdád. In personal appearance he is described as a handsome man. Among the greatest and most popular of his miracles are the following. While he was an infant at the breast, the month of Ramazán came round. The neighbours were prevented by the clouds from seeing the moon, and were in doubt whether they should begin the fast or not. On inquiry from the parents of 'Abdul Qádir, they found that he had refused the breast ever since sunrise, and this indication of the precocious young saint was accepted as conclusive.

Again a mother was travelling with her son to celebrate his marriage with the betrothed. As they were crossing the river Indus, a storm arose, and upset the boat. The boy was drowned, but the old woman escaped to the bank. There she remained for twelve years praying to the Pír i Dastgír; at the end of that period the saint appeared, and at her request prayed that the drowned boy and his comrades might be restored to life. Twice the holy man prostrated himself on the ground without result; after the third prostration, the boat and its passengers reappeared on the river. The cause of the delay was that the bodies of the drowned had been devoured by fish, and the fish in their turn had become the food of men, many of whom had died in the interval. It had been necessary to collect the scattered fragments of the drowned before they were re-animated. On another occasion the saint converted a thief who was in the act of stealing from him, and made this same thief the Quṭb or Chief among the darweshes of the city.

A fourth and equally notorious anecdote refers to the punishment inflicted on a walí named Shaikh Ğan'án for disputing the supremacy of Píran i Pír. The latter had composed a qaṣida in which the following couplet occurred :

انا الجليلي محيي الدين اسمي \* و اقدامي علي عنق الرجالي \*

"I am the resident of Jílán, my name is Muhiyyuddín, and my foot is on the necks of men." Shaikh Ğan'án denied that 'Abdul Qádir's foot

was on *his* neck, on which 'Abdul Qádir told him that the foot of a *pig* should be placed there. This was brought about by the charms of a swineherd's daughter who captivated the frail "walí," and made him carry a litter of newborn swine. She would moreover have compelled him to eat pork had not Shaikh 'Abdul Qádir compassionately saved him from infidelity, and restored him to his right mind just as his hands were stretched out, to raise the forbidden food.

The shrine at Lúdiána was founded according to the tradition by a disciple of 'Abdul Qádir, named Shaikh Mahmúd Makkí who had established himself at Lúdiána, whence he made frequent pilgrimages to his teacher's tomb at Baghdád.

Next in importance to the Roshaní fair is that held at the village of Chapár about sixteen miles from Lúdiána in the direction of Maler Kotlah. This fair is connected with a most remarkable superstition, which I cannot yet unriddle, but which I suspect is derived from some aboriginal religion. The divinity, or saint, in whose honour the fair is held, goes by the name of "Gúgá," and the shrine itself is called "máří" or "mařhí." The original "mařhí" is supposed to be situated at some indefinite locality to the south; but there are numerous small "máris" in this district besides the large one at Chapár. They are always outside the village; in size and shape they are not unlike an ordinary Hindú samáhd. The worship seems to consist in burning a "chirágh," and in salaaming with the forehead lowered and with hands, palm to palm, "mathá țekná" as it is called. The worship is in some way connected with the snake. At Chapár, though not in the smaller máris, there is a figure of a snake on the dais inside the shrine. Persons who have been snake-bitten, are taken to the máří for cure, and there is a special "mantra," called "jhárá," recited for their recovery. There is also a custom called "til chásli" of throwing down rice and til seeds in places frequented by snakes. This Gúgá worship, though specially favoured by the lower classes, is not confined to any sect. At Chapár, the guardians of the shrine are brahmins, and only Hindus of good caste actually cross the threshold, but while the front of the mařhí is allotted to them, the Muhammadans, Chumárs, and Chúras have each of the three remaining sides. Many of the smaller máris are under the guardianship of Muhammadan mırásís.

There are a great many wonderful tales chiefly of metamorphosis connected with Gúgá, but I have not yet obtained any rational or satisfactory account of the superstition itself. The inquiry is interesting, as it may throw light on ethnological questions and on the old snake-worship of India. The Chapár fair is held in the north of Bhádon.

Still more numerous than the shrines of Gúgá are those of the famous Sakhí Sultán or Sakhí Sarwar, the Musalmán saint whose great place of pilgrimage is on the frontier beyond Dera Ghází Khán. In almost every village there is one of these shrines spoken of as the "thán." Attached to them is a class of priests or rather missionaries called "bharáis." These make converts, and collect pilgrims for the annual caravans to the great shrine. This shrine is spoken of as Nigáhá, and the qáfilas are called "sangs." Thursday appears to be the day sacred both to Gúgá and to Sakhí Sultán.

The great saint or divinity of the Chúrás, or Panjáb-sweepers, goes by the name of "Lál Beg." They erect a green flag in front of their houses, place chirághs by its side, and then pay their devotions to the flag. They are very exclusive in their religious dogmas, maintaining that there will be no salvation in a future life for any but sweepers, though possibly a few Muhammadans may be admitted to heaven by inadvertently taking the name "Lál," when they repeat the *kalima* "Lá Illah, &c.

I may conclude this account of the Lúdiána district with a few words respecting the old Muhammadan capital Sarhind, which though in Patiála territory, is very near the Lúdiána border. Sarhind is now a city of desolation; not a mere mound of bricks like Sunet, but a collection of standing ruins imposing from their size and extent, but entirely desolate. The total area of the ruins is about ten miles round. The two most prominent ruins are those of the fort and of the governor's Palace or 'Ám Kháç. A road of white quartz connects the two and crosses a substantial Moghul bridge. Near the 'Ám Kháç is a large bank with a causeway leading to an island. Sarhind was long the residence of numerous families of Sayyids, and almost every third building seems to have been a mausoleum. The streets are crowded with these tombs mostly of one pattern, with three domes and a double roof. Most of the buildings have under-

ground apartments. There is a large number of wells, and each of them has a chamber connected with it. The Sikhs have built a Gurdiwára on the spot where Govind Sing's two sons were murdered.

These extensive ruins, which bear a melancholy testimony to the departed grandeur of Muhammadan rule, have been sold by the Rája of Patiálá as "ballast" for the use of the Railway. Strange to say coins or trinkets are seldom found in excavating, nor could I discover a single inscription on any one of the thousand tombs and houses which cover the ground.

About 20 miles from Sarhind is another old Muhammadan city called Páil, of which also frequent mention is made in Farishta. This is still an imposing old city, but presents, like Sarhind, the appearance of desolation, though it is not like Sarhind a ruin.

I send herewith two packets of coins. Those marked A are miscellaneous, but were collected chiefly in the Lúdiána district; of those marked B., one I believe or perhaps more than one was found at Sunet. [*Vide* Proceedings, Asiatic Society Bengal, for June, 1869.]

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PART I.—HISTORY, LITERATURE, &c.

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No. III.—1869.

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*Badāonī and his Works.* By H. BLOCHMANN, Esq., M. A., Assistant Professor, Calcutta Madrasah.

[Received 1st April, 1869.]

I.—INTRODUCTION.

This paper is the first of a series of essays which I intend to write from copious notes collected by me on the Arabic and Persian editions of our *Bibliotheca Indica*. The object of the essays is to supply pre-faces and introductions to those works of which merely texts have been printed, to collect whatever biographical information we possess of the authors of our editions, and to remark on the style of their productions. Though the subject matter, especially in the case of our historical publications, has received much attention, the style of the authors presents many interesting features, inasmuch as we can trace in their works the growth of the Persian language in India. I also intend giving translations of new and interesting passages, and thus prepare the way for systematic translations. The more texts the Asiatic Society prints, the more necessary will it become to translate the works. This is of great importance for our historical texts: as long as we have no translations, the Historians of the *Bibliotheca Indica* will be a treasure under lock and seal.

The great difficulty connected with the translation of our works is this, that in most cases the translations will have to be made in India,

where the MSS. which were used by the editors, still exist. In some works the geographical difficulties are so great, that they could not be well overcome by a translator in England; in others the allusions are so pointed that without some familiarity with the people, and some instruction and assistance from good native teachers, it would be almost impossible to write a faithful translation. Not all our works are as easy in style as the *Iqbálnámah*, the *Pádisháhnámah*, or Sayyid Ahmad's edition of the *Tuzuk-i-Jahángírí*, which works any one who has made fair progress in Persian could translate. The texts of these works, moreover, are in a satisfactory condition.

It was therefore with much pleasure that the Society lately learned that two of its members, Mr. T. W. H. Tolbort, and Mr. C. J. Lyall, are about to entrust to the Society their MS. translations and abstracts of the *Tárikh-i-Firúzsháhí*, and the reign of Akbar by Nizám-i-Harawí.

For the present paper I have selected the work known as the *Tárikh-i-Badáoní*, partly because I found a perusal of the work of great assistance for my critical edition of the *Áin*, partly because of all Indian Historians Badáoní is the most difficult to be understood; and I take this opportunity to acknowledge the obligations under which I lie to the Joint-Editor, Maulawí Aghá Ahmad 'Alí, for the assistance I received from him in preparing a MS. translation of Akbar's Reign (the second volume of Badáoní), from which some of the extracts below are taken. Badáoní is the only author among our Historians, to the peculiarities of whose character and opinions it is possible to trace the plan and the execution of his work. The opinion now current regarding Badáoní—which opinion is also held by a recent writer on Indian Historians in the *Journal of the R. A. Society of Great Britain* for 1868—is that the value of Badáoní's work lies in its giving us a view of the character of the great Emperor from an *opposite* point; *secondly*, that he was a bigoted Moslem; *thirdly*, that he could not tolerate the extremes of toleration to which Abulfazl and Faizí allowed the Emperor to go; *fourthly*, that the bitterness of the author impaired his judgment; *fifthly*, that his work when read by itself does injustice to Akbar; *sixthly*, that he writes "in unmeasured terms" of Akbar; and *seventhly*, that "his work may even give a very erroneous impression of the character, and

particularly of the motives which actuated the greatest sovereign that has ever ruled the destinies of India, in many of the measures of his government." It is one of the objects of this paper to vindicate Baddoni, and to shew that with the exception of the third statement, which is a personal matter, every one of the remaining six points is a statement capable of being disproved by quoting from his works.

But before proceeding to my task, I shall give a short outline, because I have chosen a historical writer for my first essay, of the history of our editions, as I can trace it from the records and journals of our Society. The following remarks then may serve as an introduction to the Historians of our *New Series*.\*

## II. — *Sir Henry Elliot's Scheme and the Bibliotheca Indica.*

It may at first sight seem surprising that before the appearance, in 1849, of Sir H. M. Elliot's *Index to the Historians of Muhammadan India*, but little was done for determining the sources from which the history of the Muhammadan period should be compiled. When circumstances lead men to pay attention to a new branch of knowledge, it is outlines rather, and comprehensive sketches, which are required, than critical details. But when, in the course of time, a fair knowledge has been gained of the subject and its scopes, men will proceed to analytical enquiries; and after gaining an insight into the sources, they will exercise the power of selecting that which is original from that which is borrowed. The attention which scholars before and at the time of Elliot paid to Indian History, was, however, by no means slight. This is shewn by the numerous translations which have been made by Anderson, Bird, Briggs, Chalmers (MS.), W. Davy, Dorn, Erskine, Gladwin, W. Hollingbery, C. A. Mackenzie (MS.), Miles, D. Prize, H. T. Prinsep, J. Reynolds, Rowlandson, C. Stewart, D. Shea, A. Troyer, White, J. Wilkins, &c., several of which translations were printed at the cost of the Oriental Translation Fund.

But it is the works of Sir H. M. Elliot, and his posthumous papers which, for years to come, will form the sound basis of *critical* studies. Sir H. M. Elliot, shortly before 1847, if I am not mistaken, proposed to the Government of the North West to lithograph a uni-

\* Since writing the following remarks, the *New Series* of our *Bibliotheca Indica* was reviewed in the *Times* of the 26th March, 1869.

form edition of the *Historians of India*. Though this proposal was not accepted for want of funds for such an object, Sir H. M. Elliot was asked to prepare an Index of the *Historians*, so that the proper MSS. might be selected and deposited in the College Library of Agra. The 'Index' thus called for by the Government of the N. W. 'insensibly expanded into several volumes,' of which the first and only one was printed at Calcutta in 1849. The unexpected death of Sir H. M. Elliot put a temporary end to the completion of his Index.

In March 1863, Mr. A. Grote proposed to the Philological Committee of our Society, to carry on the publication of Sir H. M. Elliot's papers, and on the 30th April of the same year the Committee [Messrs. A. Grote (President), E. C. Bayley, W. N. Lees, Rājendra Lāla Mitra, and the Secretaries, Messrs. W. S. Atkinson and E. B. Cowell] reported to the Society as follows:—

"The Committee have under consideration a proposition which has for its object an endeavour to secure the publication, even in an imperfect form, of the valuable materials which the late Sir H. Elliot had collected for his work on the '*Muhammadan Historians*.'

"It was the wish of many members of our Society eight years ago to offer the Society's aid to Lady Elliot in carrying out the author's project, but no proposition was made because it was hoped and understood that the more powerful assistance of the Home Government would be given to that end."

"The Committee are aware that the late Board of Controul in their letter, dated 4th August, 1856, to Professor Wilson, and Messrs. Morley and Bayley, sanctioned the printing of the first three Vols. of the Elliot MSS., which had been left ready for press, on the understanding that *the payment by the Court in respect of the 3 vols. is to be strictly limited to the sum of £500, excluding the remuneration to the gentleman who may undertake the superintendence of the publication*. It was hoped that the publication of the further volumes might be effected by means of private efforts." \* \* \*

"Mr. Bayley who had examined all the materials, reported on them thus:—Vols. 4 and 5, far advanced; 6 and 7, materials and outlines only ready; 8 nearly as far advanced as Vols. 10 and 11, which

“are about, say, half ready ; Vol. 9 in an equally forward state with  
“the three first vols.\*

“The arrangement which was made with Mr. Morley for publish-  
“ing the work to the extent of the Board of Controul’s grant  
“was terminated by that gentleman’s death, and no similar  
“arrangement has since been found feasible. It seems to the Com-  
“mittee that there is great risk of the late Sir H. Elliot’s labours  
“being altogether lost, unless the Society comes forward with an offer  
“to undertake the superintendence of the publication. \* \* \* \*

“The materials to be placed at the Committee’s disposal by Lady  
“Elliot. With Mr. E. Thomas’ cooperation in England, the Com-  
“mittee will be in a condition to determine what they will require  
“to be sent out, and what portion may be left with him, or accessible  
“to him, for compliance with references made to him from this  
“Committee.”

Circumstances, however, to the great regret of the Committee, prevent-  
ed the proposal from being carried out ; but Sir H. M. Elliot’s papers  
are now being published in England under the able editorship of  
Professor J. Dowson.

Though the departure of Sir H. M. Elliot from India, and his  
untimely death, had put an end to the immediate completion of his  
work, the collection of MSS. detailed in the ‘Index’ was commenced,  
and actively pursued. In 1855, the late Mr. Colvin, then Lieutenant-  
Governor of the North West, at the suggestion of Mr. E. Thomas,  
B. C. S., entrusted to Mr. H. W. Hammond, then Secretary of the  
Sudder Board of Revenue, the task of collecting and collating MSS.  
of the Muhammadan Historians of India. Mr. Hammond issued the  
following notice—

### اشتہار

سرکار کو چھپوانا کتب تواریخ مفصلہ ذیل کا منظور ہی اور تصحیح کے  
واسطے متعدد نسخے ہر کتاب کے مطلوب جسکے پاس منجملہ ان کتابوں کی  
کوئی کتاب قلمی ہو بسیدیل ڈاک بیرنگ بھنگی صاحب سکریٹری صدر بورڈ آف  
کی خدمت میں بھیج دے بعد چھپنے کے اصل نسخہ واپس دیا جائیگا اور  
ایک نسخہ چھاپہ کا سرکار سے اور عنایت ہوگا اور جسکو بیچنا منظور ہو  
کتاب مول لیجائیگی فقط

\* Vide also Dr A. Sprenger’s *Manuscripts of the late Sir H. Elliot*, J. A. S.  
Bengal, Vol XXIII.

تاریخ ورشدہ	خلاصۃ التواریخ	چہچہ نامہ	تاریخ سد
ترجمہ تاریخ یمینی	طبقات ناصری	فیروز شاہی تصنیف ضیاء ہرنی	
فیروز شاہی تصنیف شمس سراج	المصباح ظفرنامہ	مخزن افغانی	
مخبر اللباب	تاریخ چغتای	بابری تصنیف بابر	
ہمایونی تصنیف ہمایون	اکبر نامہ	سوانح اکبری	
انتخاب تاریخ ہدایونی	زبدۃ التواریخ	مآثر رحیمی	مآثر عالمگیری
جہانگیر نامہ	پادشاہ نامہ مع ضمیمہ	انتخاب حدیقہ الصفا	
عبرت نامہ	تاریخ ارادخان	تاریخ نادر الزمانی	سیر المناخرین
انتخاب تاریخ مظہری	انتخاب مذخبتواریخ	انتخاب حدیقہ الاقالیم	
وصاف	توزک تیموری		

۱۲ ستمبر سنہ ۱۸۵۵ ع

“The Government intends to print the undermentioned books, for which purpose several MSS. are required for each work. Should any one possess MSS., he is requested to send them *bearing* by Bangy-dák to the Secretary of the *Çadr* Board, *Agrah*. After printing the books, the MSS. will be returned, together with a copy of the printed work *gratis*. Should any one be willing to part with his MSS., they will be bought.”

“*Tárikh i Farishtah*,\* *Khulácatuttawárikh*, *Chhachhnámah*, *Tárikh i Sind*, *Tárikh i Yamíní* (in Persian),\* *Tabaqát i Náçirí*,\* *Fírúزشáh i by Ziá i Baraní*,\* *Fírúزشáhí by Shams i Siráj*, Extract from the *Zafarnámah*,\* *Makhzan i Afghání*,\* *Muntakhabullubáb*,\* *Tárikh i Chagatái*, *Bábarí*,\* *Humáyúní*,\* *Akbarnámah*,\* *Sawánih i Akbarí*, *Badáoní*,\* *Zubdatuttawárikh*, *Maásir i Rahímí*, *Maásir i ‘Álamgírí*, *Jahángírnámah*, *Pádisháhnámah*\* with its sequel, Extract from the *Hadíqatuççafá*, *Ibratnámah*, *Tárikh i Irádat Khán*, *Tárikh Nádiruzzamání*, *Siyarulmutaakhkharín*,\* Extracts from the *Tárikh i Muzaffarí*, Extracts from the *Muntakhabuttawárikh*, Extracts from the *Hadíqatulaqálím*, *Waççáf*,\* *Tuzuk i Timúrí*.\* 12th September, 1855.”

\* The works marked \* have since been either printed or translated.

The number of MSS. which Mr. Hammond succeeded in purchasing or borrowing amounted to no less than 67. They were—

Tárikh-i-Fírúz-Sháhi by Ziá i Baraní, 6 MSS. ; Tárikh-i-Fírúz-Sháhi by Shams Siráj 'Afif, 3 ; Iqbálnámah i Jahángirí of Mu'tamid Khán, 6 ; Tuzuk i Jahángirí, by the Emperor Jahángir, 3 ; Maásir-i-Jahángirí, 1 ; Siyar al-Mutaakhkharín, 3 ; Tárikh-i-Farishtah, 3 ; Khulácat ut-Tawárikh, 2 ; Zubdat ut-Tawárikh by 'Abdul Haq, from Mu'izz ud-dín to Akbar, 1 ; Zubdat ut-Tawárikh by 'Abd ul-Karím, from Muhammad Sháh to E. I. Company, 1 ; Akbarnámah, Part I., 4 ; Idem, Part II., 1 ; Sawáníh i Akbarí, 3 ; Sháh Jahánnámah, 1 ; Tárikh-i-Badáoni, 2 ; Maásir i 'Álamgíri of Muhammad Sáqí, 1 ; 'Álamgírnámah i Dosálah, by the same, 1 ; 'Maásir i 'Álamgíri, by Munshí Muhammad Kázim, 1 ; Tárikh-i-'Álamgíri, author unknown, 1 ; Muntakhab ul Lubáb, 1 ; 'Ibrat-námah, Vol. II., 1 ; Tárikh i Muzaffarí, 3 ; Tabaqát i Tímúriah (abstract of Vol. I.), 1 ; Zafarnámah, 1 ; Tuzuk i Tímúri, by Amír Tímúr, 2 ; Tárikh-i-Tímúri (by ?), 1 ; Malfúzát i Amír Tímúr, by Muhammad Afzal, 1 ; Nádír uz Zamáni, by Múnshí Mahdí, 3 ; Khulácat ut Tawárikh, 3 ; Hadíqat ul Aqálím, 1 ; Idem, abstract of, 1 ; Makhzan i Afgháni, 1 ; Maásir ul Umará, 1 ; (???) Sikandarí, 1 ; Tárikh Mamálik i Hind, 1.

'The MSS. of Ziá i Baraní's Tárikh-i-Fírúz-Sháhi,' says Mr. Hammond, 'were carefully collated, under my supervision, by Maulvi Faiz Ahmad, Sarishtahdár of the Board of Revenue at Agra, a man well versed in Oriental literature, a good Persian and Arabic scholar, and much employed by the late Sir Henry Elliot. He disappeared during the mutiny, and I never could ascertain any particulars regarding his fate. In collating the MSS. he was assisted by two competent Munshis. One copy of Ziá i Baraní's history, belonging to Sayyid Ahmad, was prepared for press, and (I believe) formed the basis of the text lately printed in Calcutta. This and one other MS. of Ziá i Baraní alone escaped. All the others were placed by me in a strong chest on leaving India in 1856, and were deposited in the Record Office of the Board of Revenue at Agra, which edifice was burnt during the mutiny. There were in the same box some MSS. of Arabic and Persian Dictionaries.'

'The MSS. of Shams i Siráj 'Afif's history were also collated, and some others commenced upon. I defrayed from my private means

all expenses of collection or collation of the MSS. herein referred to. I have no idea whether any grant for purposes of publication was subsequently made by the Government of India.\*

The year before Mr. Hammond had been commissioned to collect the Agra Library MSS., Mr. Morley's Catalogue of the Historical MSS. of the R. A. S. made its appearance. In the absence of the completing portion of Sir H. M. Elliot's Index, the publication of this catalogue was of the greatest importance, whilst it is still one of the best indexes to the Historical works of other Muhammadan countries.

The loss of 67 MSS. of 35 historical works is irreparable. Any one who has been collecting MSS. in India, knows how difficult it is to obtain any at all. The paucity of MSS. at the present day, is due to vermin, the climate, the impoverished status of many Muhammadan families, but especially to the introduction of printing and lithographing, which has made *kátibs* superfluous. The number of professional copyists is very small, and daily decreasing. Bearing moreover in mind that historical works, as also dictionaries, are from their voluminousness more rarely copied than *Díwáns* and other light reading, we should not have been surprised, if the loss of the Agra MSS. had frustrated the last hope of carrying out Sir H. M. Elliot's scheme of issuing, in India, editions of Native Historians.

It was therefore fortunate, as it was patriotic, that the Philological Committee of the Asiatic Society of Bengal, in 1859, took up the scheme, and resolved to print in the *New Series* several works on the History of Muhammadan India. The minute book of the Philological Committee shews that it was Mr. A. Grote, its President, who first advocated the editing of Muhammadan Historians. He says in his minute of the 26th September, 1859 :—

"I am strongly in favour of publishing the works of some of the Persian Historians of Muhammadan India. The N. W. Government had, it will be remembered, a project for bringing out a series of such histories. This, Mr. Muir tells me, has, for the present, been abandoned, all the materials collected for the publication having been destroyed at Agra in 1857. The only MSS. which escaped, were those of *Ziá i Baraní*, which Mr. Hammond had taken home

\* *Vide* Journal, R. A. S. 1868, p. 475.

“with him ; and which will probably be placed at our disposal, if we  
 “decide on undertaking its publication. I will hereafter make some  
 “suggestions as to the historians to be selected, should the Com-  
 “mittee concur generally in the propriety of including this class of  
 “works in the New Series.”

In the minutes of the Committee (26th Sept. 1859) I find the following entry :—

“*Present*—The President, Capt. Lees, Rev. J. Long, Babu  
 “Rájendra Lála Mitra, and the Secretaries [Messrs. W. S. Atkinson  
 “and E. B. Cowell]. I. Resolved that a new Series of the Biblio-  
 “theca Indica be commenced. IV. The President proposed that the  
 “Society should undertake to publish some Muhammadan Historians,  
 “particularly Zíá i Baraní (*vide* Minute attached). Approved of.  
 “Information should be collected respecting MSS. and a competent  
 “editor.”

These recommendations were adopted by the Council of the Society. The Committee soon gave proofs of its continued activity. At the meeting of the 16th January, 1860, a letter was read from Sayyid Ahmad Khán of Murádábád, offering to edit Zíá i Baraní. It was resolved to accept his offer, and to ask him to send the MS. to Calcutta.

On the 12th April of the same year, Mr. Grote circulated the following extract of a letter written by Mr. Morley to Mr. E. Thomas—

“I am much pleased to find that Persian texts are to be printed in the *Bibliotheca Indica*, and that Mr. Grote begins promisingly. I should not at all object to send my collated transcript of *Baihaqí* to India, if I were sure that it would be printed, but not else. I wrote it, in the first place, faithfully from my own MS. which you have, and in it is noted *every variant*, without reference to sense, from Sir H. Elliot’s MS. and the one in the Paris Library. Printing a correct text from my collated transcript would be an easy task for any painstaking Persian scholar.

P. S. The *Baihaqí* amounts to 372 pages, small Svo., 19 lines in a page.”

The editing of *Baihaqí* was happily not interfered with by the death of Mr. Morley. At the meeting of the Committee on the 15th

August 1860, the President announced the decease of Mr. Morley ; but he added that Mr. E. Thomas had seen the Executors, and had secured from them the promise that the MS. of *Baihaqí* should be sent out to India. On the receipt of Mr. Morley's transcript, it was immediately forwarded, as had been done with Sayyid Ahmad's *Fírúزشáhi*, to Major Lees' press.

In their Annual Report for 1861, the Council announced to the Society that four fasciculi of *Ziá i Baraní* and two fasc. of *Baihaqí* had been issued. The completion of both works was announced in the Annual Report of our Society for 1862. At the annual meeting the President (Mr. A. Grote) remarked :—

“The series of Persian historians is one, in the progress of which I take a special interest, an interest borrowed from others, but not the less genuine for not being original. The late Sir H. Elliot and Mr. John Colvin were the first movers, as is generally known, on behalf of the publications in question, which the active co-operation of Mr. E. Thomas had just pressed into a project, when the troubles of 1857 caused all idea of it to be dropped. It was resumed some three years ago by the Philological Committee at the suggestion, I believe, of myself, since I, as your Secretary, had been all along in close communication with those friends whom I have just named. The first work, the *Tárikh i Fírúزشáhi* of *Ziá i Baraní*, which the Committee undertook to recommend to the Council, was that which was to have opened the series under the auspices of the North-Western Government. I indulge in the hope that much may yet be done towards carrying out, not only thus partially, but in its entirety, the task to which Sir H. Elliot had devoted himself, and which was occupying him when he died. The mass of valuable materials which he had collected, ought not to be allowed to remain inaccessible to the many who desire to consult them and profit by them.”

On the 23rd April, 1862, Mr. E. B. Cowell proposed that the *Tárikh i Badáoní* by 'Abdul Qádir be undertaken in the Series of Indian Historians. At the same meeting, Major Lees also, guided by Morley's Catalogue, proposed to edit such portions of the *Ṭabaqát i Náḡirí* as had a reference to India. The minute Book contains the following entry :—

“VI. Read a *Memorandum* by Capt. Lees connected with the

prosecution of Persian and Arabic publications by the Society, and resolved that the Committee cordially concur with him in the propriety of publishing the *Ṭabaqát i Náṣirí*." The *Memo.* alluded to, I have not been able to trace among the records; but the substance of it may be embodied in Major Lees' remarks on p. 465 of our Journal for 1864. Regarding the *Ṭabaqát i Náṣirí*, he says:—

"Of the contents of the work, the late Mr. Morley in his Catalogue, "gave a brief outline; and from the examination I made of the book, "his remarks appear to convey an accurate impression of its value: "of the propriety then of our publishing the portion mentioned [Ghori "Dynasty up to Náṣiruddín Mahmúd], there could not, I think, be a "question."

Mr. Cowell's proposal to print the *Tárikh i Badáoní* was accepted on the 8th April, 1863. The following entry refers to it:—

"Capt. Lees' Report on the MSS. of the *Tárikh i Badáoní* was read and approved; but his suggestions relative to the *Ṭabaqát i Akbarí* to be deferred to a future meeting."

It is a matter of regret that the printing of the *Ṭabaqát i Nizám i Bakhshí\** was allowed to be deferred. The three very inferior MSS. of the *Tárikh i Badáoní* were handed over to Maulawí Kabiruddín Ahmad, who edited the second volume (Akbar's reign); afterwards, for the first and third volumes, they were given to Maulawí Aghá Ahmad 'Alí of the Calcutta Madrasah.† The completing fasciculus of the whole work, together with a short biographical notice of Badáoní in Persian, has just been issued.

The Annual Report for 1864 announced the completion of the *Ṭabaqát i Náṣirí*, and the issue of five fasciculi of *Badáoní*.

During 1865, the historical editions were vigorously proceeded with. On the 22nd June, 1864, Major Lees proposed that the *Iqbálnámah i Jahángírí* should be printed. Though it was of little advantage to print this work as it is a *verbatim* extract from the *Tuzuk i Jahángírí*‡

\* Called by mistake *Nakhsabí* on p. 468 of our Journal for 1864.

† *Vide* Journal A. S. Bengal for 1868, No. I., p. 20.

‡ I have collected the places in the *Iqbálnámah* which contain either new items of information, or differences from the *Tuzuk*, and trust to have shortly leisure to put them in form of an essay. If one of the two works is to be translated, it must be the *Tuzuk* (Sayyid Ahmad's edition). There are few works which contain more *collateral* information than the *Tuzuk*.

which had been printed the year before by Sayyid Ahmad of Alighur (1864), the Committee and the Council resolved to print it. The MSS. were handed over to Maulawī 'Abdul Hai and Aghā Ahmad 'Alī, whose edition is carefully got up, and generally free from typographical errors.

On the same day also, the Committee resolved to publish a revised edition of the *Āin i Akbarī*, and to apply to Government for a special grant. Dr. A. Sprenger, to whom Sir H. M. Elliot also owed so much in his search for rare MSS., had, on several occasions, even before the *New Series* was commenced with, pointed out to the Philological Committee the importance of a critical text of the *Āin*.

On the 12th November, 1865, Major Lees proposed that the Committee should print the *Pādishāhnámah* of 'Abdul Hamīd i Lāhorī, and the *'Ālamgīrnámah* by Muhammad Kāzīm. The latter was edited by Maulawī 'Abdul Hai and Khādīm Husain, the former of whom lately favoured the Society with a minute *Index* (now printing) of names, an *Index geographicus*, and a List of Errata which, in the absence of a translation,\* will be of great assistance. The MSS. of the *Pādishāhnámah* were handed over to Maulawī 'Abdurrahīm and Kabīruddīn Ahmad of the Madrasah. The work is rather bulky, and awkward for references being made to it, especially as there is no index of names, &c. Its style, however, is easy, though not half as polished as the elegant *'Ālamgīrnámah*.

In 1866, the Government of India granted Rs. 5000 for a critical edition of the *Āin*, which was commenced in March 1867. Up to the present moment, eight fasciculi of the text, and three of an English version have been printed.

On the 2nd March 1868, Major Lees, shortly before his departure for Europe, proposed that the Committee should print eight other historical works, including the *Ṭabaqāt i Akbarī*, of which the Council selected the voluminous, but valuable, *Khāfī Khān*, which is now being edited by Maulawī Kabīruddīn. The endeavours which have been made to collect MSS. for the *Maāsir i 'Ālamgīrī* have not been successful.

\* A portion of the *'Ālamgīrnámah* (passages relating to Burma and Assam) has been translated (Library A. S. Bengal, No. 32).

## III.

*A Biography of 'Abdul Qádir.*

'Abdul Qádir was born on the 17th Rabi'ussání 947 (21st August, 1540) at Todah,\* in the Sirkár of Rantanbhúr, which belonged to the Qúbah of Ajmír. Regarding the year of his birth, he says in his history—"In this year Sher Sháh gave the order to build from Baugál to Rahtás in the Panjáb (a distance of four months' travel), and from Ágrah to Mandú in Málwah, at every *kos*, a house for travellers with a Masjid and a well. He appointed for each *sarái* a *Muazzin* and an *Imám* (leader of the prayer), and even a Muhammadan and a Hindu,† who were to provide travellers with water and the indigent with food. He also planted, on both sides of the road, trees which formed an avenue in the shade of which people could travel. Even now-a-days, though fifty-two years later, the traces of this road are in many places visible. During the reign of this good king, justice was everywhere so efficiently provided for, that an old man, for example, might have anywhere lain down to sleep with a golden plate in his hand, and yet no thief would have taken it away from him. Thanks be to God that during the reign of such a king the author of this history was born! I might apply to my case the words which our blessed prophet said of the time of his birth, 'I was born during the reign of the just king [Naushírwán the Just].'"

We know nothing of the circumstances of 'Abdul Qádir's father, whose name was Mulúk Sháh ibn i Hámid.‡ The family appears to have chiefly lived at Basáwar, or Bhasáwar, a town of the district of Bayánah on the route from Ágrah to Ajmír, and generally spelt on our maps *Bissower* or *Busowar*. There 'Abdul Qádir spent the first years of his life (II, 236). His maternal grandfather, Makhdúm Ashraf, took much interest in him, and taught him the elements of Arabic Grammar (II, 63). It appears that Makhdúm Ashraf held a military post; for 'Abdul Qádir states that, in 955, his grandfather was with the contingent of *Faríd Tárin*, a commander of Five thousand, at Bajwárah, near Bayánah (Qúbah of Ágrah). About that time, his

\* I, p. 363; II, p. 236.

† Hindús will not drink water from the leather bags of the water-carriers.

‡ II, p. 252, Sir H. Elliot in one of his extracts from Badáoní calls 'Abdul Qádir's grandfather *Jáh*, according to the reading of the MS. belonging to the Society which he used. All other MSS. have *Hámid*.

father Mulúk Sháh, went to Sambhal, where 'during the reign of Islem\* Sháh (952 to 960)' 'Abdul Qádir learnt to read and chant the Qorán. At Sambhal also lived Shaikh Panjú, the spiritual guide (*pír i dastgír*) of his father Mulúk Sháh. The Shaikh who was a pupil of the famous Shaikh Adhan of Jaunpúr, was as distinguished for his profundity in Qúfism, as for the beauty of his voice, and for his talents of speech and address; and it is perhaps from him that 'Abdul Qádir acquired the fine intonation which subsequently recommended him to Akbar. In 960, while still at Sambhal, 'Abdul Qádir studied Muhammadan law under Miyán Hátim and Shaikh Abulfath, son of the renowned Shaikh Iláhdíyah† of Khairábád (II, 286). With the former 'Abdul Qádir studied the *Kanz i fiqah i Hanafí*, and became in time his direct disciple (*muríd i rashíd*), when Hátim honoured him with the cap and the 'tree' of his own teacher 'Azízullah. Hátim, who died in 969, must have been a Shaikh of great renown; for not only has 'Abdul Qádir placed him first among his biographies of the learned of Akbar's reign (Vol. III), but Abulfazl has done so likewise in his list of the learned (Second book of the *Áin*).

During 'Abdul Qádir's stay in Sambhal, Basáwar and the surrounding districts were plundered by Hemú in his expedition (961) against Ibráhim Khán; and the exhausted state of the district was rendered mere pitiable during the dreadful famine of 962, when 'Abdul Qádir witnessed the death from hunger of thousands and the dreadful sight of man eating man (I, 423). During the sack of Basáwar by Hemú, the library also of 'Abdul Qádir's father perished.

In 966, the third year of Akbar's reign, 'Abdul Qádir accompanied his father to Ágrah, where he lived in the house of Mihr 'Alí Beg Saldoz, who subsequently rose to high dignity. After a journey with Mihr 'Alí Beg (related in Elliot's Index, p. 233) to the fortress of Chanár, 'Abdul Qádir continued his studies in Ágrah, under Shaikh

\* *Islem*, with the *yá i majhúl* (e), is the vulgar and Indian pronunciation for *Islám*; hence we also find towns called *Islempúr*. This change (*imálah*) of a long *á* to *e* has in many words become classical. Another well-known Indian example is *hawell*, the environs of a town, for *hawál*, which has now-a-days taken another meaning. But *اسلام*, with the *imálah*, is never pronounced *islám*. Vide Elliot's Index, p. 229, note 2.

† *Iláhdíyah* is the Hindústání for the Persian *Iláhdád*. Another form is *Allah díyah*, pr. God has given, *Theodore*. So also *Iláhábád* and *Alláhábád*, *Iláhwirdé Khán* and *Alláhwirdé Khán*.

Mubárik of Nágor. This Mubárik is one of the most remarkable men of Akbar's reign. He had the good fortune of seeing his eldest son, Abul Faiz, acquire the renown of being the second greatest poet that Hindústán has produced; whilst his second son Abulfazl became the greatest statesman and patriot that Muhammadan India can point to. Shaikh Mubárik was, moreover, one of the principal causes of Akbar's apostasy from the Islám. The heretical influence which he even exercised on 'Abdul Qádir, who at that time had commenced rigourously to walk on the path of the law and the commentaries, is clearly visible in his belief in the approach of the Millennium, of which I shall say a few words in connection with 'Abdul Qádir's character.

The law studies which 'Abdul Qádir continued at Agra, remained his favourite occupation to the end of his life. Under Shaikh Mubárik he had made friendship with Abul Faiz and Abul Fazl; under Qází Abul Ma'alí, a lawyer who had come to Agra from Bukhárá, he had Naqíb Khán as class fellow (*hamsárah*), who subsequently played an important part under Akbar and Jahángír.

Thus we see that, as far as education and society were concerned, 'Abdul Qádir enjoyed all those advantages upon which success in after-life depends.

In 969, 'Abdul Qádir and Shaikh Muhammad, his younger brother, had to mourn over the death of their father. His body was carried from Agra to Basáwar. In the following year, Makhdúm Ashraf also, 'Abdul Qádir's grandfather, died at Basáwar. "Thus in the space of one year," says 'Abdul Qádir in chronicling these events, "nothing but grief entered my heart, which up to this time had been so thoughtless; and sorrow which I had hitherto avoided, stepped up in all its ruthlessness and attacked me. The meaning of '*It has befallen me*' became now clear to me, and I saw the truth of what my father had once told me, "that my light-mindedness would last as long as he was on earth; but afterwards people would see how I would go on without him, and how I would scorn the world and everything connected with it."

'Abdul Qádir soon after removed to Badáon (بداون)\* where he

\* The word *Badáon* has the accent on the penultima, and a final nasal *n*; hence *badáoní*, with a short *o* or *u*, and the Shaki i Hamzah above the *wáw*, an inhabitant of Badáon. The transliteration *Baddáuní*, which I have seen in

stayed till 973. He then removed to Patiyálá (پتیاالا), and was introduced to Husain Khán, the Jágirdár of the town. This man was at once the Bayard and the Don Quixote of Akbar's Court. He belonged to the chiefs who under Humáyún had re-conquered India; hence he was in high favor with Akbar, who had raised him to the dignity of a Commander of Three thousand (Aín Second Book, Aín 30, No. 53). But he was a pious monomaniac; he thought of nothing else but treasures and gold bars concealed in the Hindu temples of the Sawálik Range, and he undertook predatory expeditions, from which he returned poorer than he had been before. His enthusiasm was ever in advance of that of his men who, badly equipped as they were, had not only to suffer hunger and thirst, but never found the gold bars for which they and their master got their heads broken. When Governor of Láhor, he used to eat bread made of oatmeal—'his fare was not to be better than that of his prophet.' He would not indulge in the luxury of a *chárpaí*, or bedstead—'had not saints slept on the ground?' It was known that he had never committed an unchaste deed. Property he had none. The contingent which he ought to have kept as a Commander of Three Thousand was never in proper order; and though Akbar had added the town of Shamsábád to his jágir, his liberality towards the poor and pious left him no money to get horses for his men. On one occasion (II, p. 94), he lost for this reason the command of an expedition. Sometimes he had not a horse for himself; or his servants had to bring him a horse, because he had given away his last and only horse as a present. "Money kept at home," said he, "is a thorn in my side." A poet said of him—*Khán i muflis, ghulám i básámán*—'A poor lord with rich subjects.' When, in 983, he died from a wound which he had received on his last expedition in search of Hindú gold bars, he was one lac and a half in debt; but his creditors tore up the receipts, partly because he had no assets, partly

some works, is misleading; for *باداونی* has the *wazn* of *مفاعیلن*, ٥ — ٥ —, and *Badáuní* would be *مفاعیلن*, ٥ — — —. For *باداون*, we find an old spelling *باداونون*, with a nasal *n* after the *Alif*. The spelling *بادایون*, with a *yá* after the *alif*, is quite modern.

The town was famous as the 'abode of saints.' The 'Chronicle of Badáon,' published in Urdu by the Rohilkund Library Society, gives the names of fifty-one 'worthies.'

because they loved the man. He was tall of stature, and possessed immense physical strength. He fought like a lion. His war cry was, "Death or victory !"; and when people asked him why he did not say "Victory or death," inverting the order of his battle call, he said, "Oh, I do long to be with the saints that have gone before !"

His piety and reverence for the Sayyids, the learned, and every thing Islámitic, frequently led him into serious mistakes. Once, at Láhor, a Hindú had come to one of his meetings, who wore a long beard as Muhammadans do. Mistaking him for a co-religionist, the old warrior shewed him every mark of respect, and even humility. When people informed him of his mistake, he gave the order that every Hindú at Láhor should sew a piece (*tukrá*) of cloth over the place where the sleeve is sewn to the coat; and the rigour with which he exacted compliance to his order, procured him the nickname of *Tukriyah*, the Patcher. Nor would he allow Hindús to use saddles (*zín*) when on horseback, because the Muhammadan law denies infidels this boon; but he only allowed them a wallet (*pálán*).

Another time, at Lak'hnaú, he appointed a man as his Vakíl, because he was a Sayyid, when sometime after his relations, to his infinite disgust, told him that his Vakíl was a *Shí'ah*.

The last expedition which Husain Khán led, was as much directed against the imperial collectors who oppressed the poor, as against Hindú temples with hidden gold bars; and Akbar had the greatest difficulty in believing that Husain Khán had not rebelled. "People," says 'Abdul Qádir, "think him mad; but he is wise and lowly in heart." His piety was so sincere, that Badáoní thinks that Akbar would never have renounced Islám, if Husain Khán had remained alive.

This was the man to whom 'Abdul Qádir, in 973, had been introduced, and whose service he entered. He had at that time the idea of going to Court; but the liberality of Husain Khán and the regard he shewed to learned men, induced 'Abdul Qádir, for the present, to give up all thoughts of applying to Akbar. He preferred the appointment of *Qadr* of Husain Khán's jágír. As such, he had to look after the poor of the district, and attend on his master for religious matters, as leading the prayer, &c.

During the nine years (973 to 981), which 'Abdul Qádir remained with Husain Khán, he shared the transfers, and the adventures

of this Knight-errant of the Crescent. In 974, when Akbar and his grandees were engaged in suppressing the rebellion of Khán Zamán, which ended with the defeat and death of the rebellious chief at Mungarwál, near Allahabad, 'Abdul Qádir lived for a short time in Ágrah, where he met Mírzá Nizám uddín Ahmad (II, p. 99,) who subsequently wrote the *Ṭabaqát i Akbarí*, and became his warm friend.

In 975, 'Abdul Qádir married a second wife at Badáon (II, 105). Of his first marriage he has left no record. The event was the occasion of a pretty *Tíríkh*, — گشت ماهی قرین بهرے شد، 'I said, a moon in conjunction with a sun,' which gives 975.

Soon after, 'Abdul Qádir followed his patron to Lak'hnaú, to which place Husain Khán's jágir had been transferred by Akbar. 'Abdul Qádir made use of his stay in Audh to visit the principal saints and the learned men of the time. The sojourn at Lak'hnaú was, however, of short duration; Husain Khán's jágir was again transferred to *Kánt o Golah* (Sháhjahánpúr), and mortified at the transfer, the old hero set out on an expedition against Hindú temples and their hidden treasures.\* 'Abdul Qádir did not accompany him, but asked for leave to go to Badáon where he got his younger brother, Shaikh Muhammad, married. The union, says Badáoní, was productive of mischief, and appears to have led, towards the end of 977, to the death of Shaikh Muhammad. 'Abdul Qádir's sorrow at this loss was increased by the death of his infant son 'Abdullaṭíf. The *Tarkīb-band* in which he has expressed his grief (II, pp. 127 to 132,) is very fine, and shews the powers of his poetical genius.

In the beginning of 979, 'Abdul Qádir rejoined Husain Khán at Kánt o Golah, where he continued his duties as almoner. In the same year 'a dreadful event' befell Badáoní, which is best related in his own words (II, p. 136). "I went to Makkanpúr, which belongs to the Sirkár of Qannauj, in order to visit the tomb of Sháh Madár.†

\* This expedition has been translated in Elliot's Index, pp. 235, 236. The corresponding passage in the Text edition will be found on p. 125, of the second volume of Badáoní. Lines 6 to 8 are unintelligible; for دختره read دختر; for *bainika* read *bainaka*; گذرا has no sense; for بیتابی we expect the name of a town.

† Vide Garcin de Tassy, *La Religion Musulmane dans l'Inde*, p. 52 (second edition). The word *Qannauj* is differently pronounced. The spelling *Kanauj*

As it is the case with all men that are 'brought up on pure milk,' light-mindedness—Adam's legacy, and the source of repentance, cruelty, ignorance, sorrow, and injury—brought me into a foolish scrape. This light-mindedness I called *love*, and after getting entangled in the net of voluptuousness, I had to suffer what fate had ordained. An extraordinary row took place in the vault where the saint lies buried; but it was not only God's anger, but also His mercy, that I was made to suffer for my crime in this world. Some people belonging to the family of the beloved got hold of me, and inflicted nine sword wounds on my head, hands, and shoulders. But the wounds were only skin wounds, with the exception of the wound on my head; for my skull sustained a fracture, and the brain was laid bare. Besides, the vein of my little finger had been cut through. I fell into a swoon, and thought it was all over with me. But by and by I recovered and got well. I hope, I shall likewise get off as easily in the next world. At Bángarmau,\* I fell in with a skilful surgeon, under whose care my wounds commenced to heal up within the course of a week. In my pains, I vowed to perform the rite of pilgrimage to Makkah; but this vow has up to the present time (1004) not been fulfilled. \* \* \* From Bángarmau I returned to Kánt o Golah. After the bath of recovery, however, I was again confined to my bed. May God Almighty reward Husain Khán with a place in Paradise; for he tended me with the care of a father and a brother, and did more than man can do. As the cold of the season made my wound quite numb (*gazak*), he prepared for me a salve of *Tamarix*, and also fed me on Tamarix sweetmeats. At last I went to Badáon, in order to consult another physician. He re-opened the wound, which brought me to death's door. Once while in a state of torpor, I had a dream. A number of collectors of taxes had taken me up to heaven, where I saw a *daftar*, a *Dhwán*, and clerks. Some mace-bearers, who resembled the mace-

or Qanaúj, is very common; but several verses of the Sháhnámah and Nizámi's Sikandarnámah read *Qannauj*, with a double *n*, as is proved by the metre; vide Vullers' Dict. under قنوج. Dawson's edition of Elliot's works (II, p. 52), quotes a commentator who spells *Kinnauj*, which is also the spelling given in the *Taqwím ulbuldán*.

\* بانگرمو. The Aín spells this name بنگرمو Bangarmau. Our maps have *Bingermow*; it lies in Audh (south), and belonged to the district of *Unám* (on our maps Onáo, on the Lak'hnaú railway). There are many towns in Audh and Bareli, the names of which end in *mau*.

bearers attending on the kings of the world, with staffs in their hands, got hold of me, and hurried me about, when one of the writers who looked over a sheet of paper, said, "This is not the one." Trembling all over I opened my eyes; but from that moment I felt relieved, and the story which I had often heard when a child, proved true."\*

The perusal of this 'lovescape' makes upon us a different impression from what it will make upon a Muhammadan. First of all, 'Abdul Qádir's "beloved" was a young boy. But whilst we, in censuring 'Abdul Qádir, would expect that the thought of his family and his office, his education, and his religious sincerity, should have protected him against committing or attempting an unnatural crime, a Muhammadan would rather look upon the whole story as a mere example of the power of love. In the East, it is a recognized fact that love to a boy renders a man mad, and makes him in the eyes of his neighbours an object of sympathy rather than of censure. The element of immorality enters but slightly. Even now-a-days, when such cases come to the notice of educational officers, the excuse constantly brought forward is, that the offender had temporarily become a *káfir*—a phrase only too frequently borrowed from the poets,—and that such love scandals are matters of fate as every thing else, so that the ends of justice are better met with by watching or locking up the boy than punishing the offender. As 'Abdul Qádir has related the story himself, we might feel inclined to give him the credit of being an unbiassed historian who will even relate events to his own disadvantage. He certainly might have suppressed it; but the story is related as a 'dreadful event,' and deals more with the thrashing and the wounds he got than with the crime itself.

Later, in 989, when he was forty-two years old, 'Abdul Qádir once more experienced the power of love (II, p. 297); and though he wilfully absented himself from Court, in order to be near the beloved boy, the affair was more platonic, and ended in a few ghazals and an often repeated desire of dying during a meeting with the beloved.

\* *I. e.*, that when a man dreams of death, it signifies life. The study of dream books is as profitable as the study of the proverbs of a nation. If we compare the interpretations which different nations attach to one and the same dream, we discover most curious coincidences and contrasts indicating a difference in national character. Lithographed *Khwáb-námahs* command a most extensive sale in the bázárs of India.

Whilst recovering from his wound, 'Abdul Qádir witnessed the total conflagration, in 979, of the town of Badáon.

Towards the end of 981, 'Abdul Qádir fell out with his old patron, Husain Khán, in whose service he had been for nine years (II, 172). He does not state the cause of the disagreement; but to judge from his remarks, he felt himself wronged. Husain Khán in vain asked Badáoní's mother to intercede for him: her son had made up his mind to go to Court, and thus carry out the plan which he had made before entering Husain Khán's service.

'Abdul Qádir was introduced to Akbar by Jaláluddín Qúrchí, a commander of Five Hundred, and a personal friend of the emperor, and by Hakím 'Ain ul mulk, one of the Court Doctors. "As in those days," says Badáoní, "knowledge was a marketable commodity, my mere arrival at Court procured me His Majesty's favorable notice. He made me at once join a disputation which was going on among some learned men 'that beat the drum of profundity, and in their pride, care for no one.' His Majesty watched me closely. With the help of God, my force of character, my subtle understanding, and youthful boldness, gained the victory. The emperor praised me very much, and remarked that I was the man for Háji Ibráhim of Sarhind. As His Majesty wished to see the Háji defeated in argument, he appointed me as opponent. The manner in which I acquitted myself, entirely satisfied the emperor. But Shaikh 'Abdunnabí, the renowned *Çadr* of the realm, disliked me, as I had not consulted him before my presentation at Court. But when, during the discussion, he saw me placed on the opposite side, he did according to the proverb, 'He who has been bitten by a serpent, will eat opium,' and gradually allowed his dislike to change to friendliness."

Immediately after 'Abdul Qádir's introduction at Court, Abulfazl was presented to the emperor. 'Abdul Qádir hated and envied Abulfazl from his first appearance at Court; he must have known him in the house of his father who was their teacher, and may have looked upon him as a younger school comrade. The high opinion which Akbar had formed of 'Abdul Qádir's learning and disputational powers, was transferred to Abulfazl, who not only possessed 'Abdul Qádir's learning, but the boldness of thought and breadth of opinion which dazzled the Court, and excited the jealousy and envy of the 'Ulamás.

The mistake which 'Abdul Qádir made in the very beginning, and which he would not rectify, though even advised by Akbar himself, consisted in this, that he preferred for his services a grant of land (*madad i ma'ásh*) to having his name entered on the list of the army (*dágh kardan*). These were the two roads for young, ambitious men at the time of Akbar. But 'joining the army' had in those days a different meaning from what it now has. A civil service did not exist : every servant of the government, or rather every servant of the king, was on the rolls of the army, and though perhaps in civil employ, was liable to field service, and had to keep up a contingent of horses and beasts of burden, which at stated times were mustered by Akbar. The custom then obtained to brand the animals (*dágh kardan*) at each muster, after which the troopers got their pay from the treasury, and the officers received their assignments on the revenue of the districts where they were stationed. A young man, therefore, on joining the service of the emperor, got a commission as *Dahbáshí* (commander of Ten), or as *Bístí* (commanded of Twenty), to which offices salaries of Rs. 100 and Rs. 135, respectively, were attached. Promotion was rapid and depended upon personal exertions.

'Abul Qádir, however, did not care for the 'brand' of the emperor. Mir Sayyid Muhammad, the *Mír 'Adl* of the empire, strongly advised 'Abdul Qádir to join the army. "Young man," said he, "do not run after a grant of land, and do not submit to the insolence of the *Çadrs* (III, p. 75). Take the brand of the emperor; see only how grand and proud His Majesty's officers are." "As I would not listen," said 'Abdul Qádir, subsequently, "I had to see what I saw and had to suffer what I suffered."

Abulfazl at once submitted to the *dágh*; and whilst 'Abdul Qádir, when he wrote his history, had to struggle hard for the retention of the one thousand *bíg'hahs* of land which Akbar had granted him, his younger school comrade was prime minister of India, and was in receipt of a salary of Rs. 14,000 *per mensem*.

About a year after his introduction to Akbar, 'Abdul Qádir 'on account of the beauty of his voice,' was appointed Court Imám for Wednesdays (II, pp. 206, 226). As such, like the Imáms of the other six days, he had to be present at the five daily prayers. The Eunuch Daulat Házir, whose duty it was to call 'Abdul Qádir, when

the people were ready for prayer (*iqámat*), appears to have given him much annoyance. "After having been appointed Imám," he says, "His Majesty told me to join the army; and giving me an inconsiderable sum of money for an outfit, he ordered me to take a *Bístí* ship, and to bring the regulated number of horses to muster. Shaikh Abulfazl, who had lately joined Court, and who, to use Shiblí's phrase with respect to Junaid [two celebrated saints], had come out of the same oven as I, accepted at once, cunning and time-serving as he was, the military career. He brought his horses to muster, and shewed himself so officious, that he ultimately received an appointment as Duhazárí, and was made minister of the empire. But inexperienced and simple as I was, I could not bring myself to join the army, and thought of the verse which a Sayyid of Injú [Mír Jamáluddín Husain] had said when in similar circumstances, 'You make me join a contingent, and appoint me to a command of Twenty. Good God, if my mother saw me in this wretched plight!' My wish was to be content with a grant of land which the emperor might bestow upon me as a means of livelihood; I thought of quietly retiring from the bustle of the Court, and passing my life in study and independence.\* \* \* But this wish has not been fulfilled. In the month of Shawwál 983, I applied for leave, which was not granted. His Majesty said he would exempt me from military duties, and gave me about one thousand *bíg'hahs* of land. This was at that time the maximum allowed to such as applied for grants, and corresponded to the salary of a Commander of Twenty; but on account of the unwillingness of the *Çadr* ['Abdunabí] and the wretchedness of the present hard times I could not get more. Unfortunately the thousand big'hahs were described in my grant as *madad i ma'ásh* [not as a *jágír*, which is given for services at Court]; and as on several occasions I represented that it was impossible, on so small a grant, to live constantly at Court, His Majesty promised to let me have an increase on the military list. Shaikh 'Abdunnabí, the *Çadr*, told me plainly that he had never seen a man of my class getting so large a grant of land. The promised assistance from the military list has, however, remained up to the present time [1005] buried in the will of God, though twenty-two years have elapsed. Times have now altered; and though once or twice I had a present, His Majesty's promise was a

beautiful *mirage*. My attendance at Court has brought me no profit, and I look forward to an act of God's mercy, to get rid of the awkward fetters which have fallen on my neck."

The part which 'Abdul Qádir took in the religious discussions held by Akbar at Fathpúr Síkrí, has been noticed in my translation of the *A'in i Akbari*, (pp. 171 to 179). Though his argumentative skill raised him in the eyes of the emperor, 'Abdul Qádir, in the pride of his success, forgot that he challenged his own set, and was actively working against his own advantages; and when after the downfall of the 'Ulamás in 987 (*A'in*, pp. 186, 187), and the resumption by Akbar of nearly all grants of *madad i ma'ásh* tenures throughout the whole empire, 'Abdul Qádir was allowed to retain his thousand *bíg'hahs*, he owed his luck more to the generosity of Akbar, who never forget an old servant, and to the good will of Faizí and Abulfazl, his old school comrades, than to distinguished services of his own.

In 983, 'Abdul Qádir once more met with old patron, Husain Khán, who had been brought to Fathpúr Síkrí dangerously wounded on one of his customary expeditions. The wound was badly treated, and would not heal up, dysentery (*is-hál i kábid*) having acceded, to which the hero succumbed (II, p. 228). In the beginning of 984, 'Abdul Qádir joined an expedition against Ráná Kíká, whose strongholds, Gogandah and Konbhalner, were to be attacked by Rájah Mán Singh. When the expedition started from Ajmir, where Akbar had visited the tomb of the Saint Mu'in, 'Abdul Qádir accompanied for a short distance some of the courtiers that took part in the expedition. "As I felt much inclination," says he, "to join an expedition against Infidels, I returned, and reported myself to Shaikh 'Abdunnabí, and asked him to obtain for me the permission of the emperor to go to the scene of war. Though he had no objection, he left the matter to his headman, Sayyid 'Abdurrasúl; and as he delayed to accede to my wishes, I applied to Naqíb Khán, whom I looked upon as my brother. At first, he was unwilling, and said, "If the emperor had not appointed a Hindú\* as Commander, I would

\* The jealousy of the Muhammadan courtiers was always roused when a Hindú was appointed to a high command. Even when Todar Mall, in 971, was appointed to assist Muzaffár 'Alí, then minister of finance, the Muhammadan courtiers, in a body, complained to Akbar, and asked the emperor, to

have been the very first to apply for permission to go." I replied that I looked upon the emperor as the Commander, and had nothing to do with Mán Singh; but I had resolved to go. One day, when His Majesty sat on a high dais in the tomb of Mu'ín i Chishti,\* to which a ladder was attached, Naqíb Khán mentioned my request. "Is he not an Imám," asked the emperor. "How can he go?" Naqíb Khán replied that I was anxious to join a religious expedition, whereupon His Majesty called me and asked whether I was in earnest. I said, I was; and when the emperor enquired after my reason, I replied, "I wish to make my black whiskers red [with the blood of infidels] in Your Majesty's service." "You may go," said Akbar, "and bring me the news of victory." After this he fell into a reverie, and then prayed devoutly a *Fátihah* [the opening chapter of the Qoran]. But when from within the dais I tried to shew my gratefulness by touching the feet of His Majesty, he drew them back; but he called me as I returned from the office of the Díwán, and giving me a handful of *Ashrafís* (goldmuhurs)—in all fifty-six,—he bade me adieu. On taking leave from Shaikh 'Abdunabí, who in those days had become my well-wisher and had overcome the dislike which he had formerly taken to me, he exhorted me not to forget to include him in my prayer before battle; for according to a genuine tradition, the Prophet had said that the battle line was the place where man had his prayers heard. I also asked the Shaikh to read a *Fátihah* for me. I then got my horse ready and set out with a few friends whose thoughts and plans were similar to mine."

"The expedition from the first to the last, was successful. I took the news of victory to Fathpúr Síkrí, as also the famous elephant of Ráná Kíká, which to capture had been one of the objects of the expedition."

Towards the end of 984, 'Abdul Qádir fell ill; but he afterwards joined Akbar at Dipálpúr in Málwah, and accompanied him, in Rajab

remove Todar Mall. "Have you not each," said Akbar, "a Hindú manager on your estates? Why do you complain, if I do as you do?" *Bad.* II, 96. In another place, Badáoní says, "The Hindús are indeed mighty fellows; the soil belongs to them, and they have half the army."

\* The great veneration in which Akbar held this saint, explains the inscription *yá mu'ín*, O helper! which we find so often on his coins.

985, to Ajmír (p. 251). The emperor, at that time, allowed several courtiers to go to Makkah. 'Abdul Qádir also applied; but Akbar made his permission dependent upon that of Badáoní's mother, who naturally refused to let her only son and supporter go. On returning to Dihlí, 'Abdul Qádir heard at Rewárí that one of his wives had been delivered of a son, to whom the Emperor gave the curious name of '*Abdul Hádí*. The words *Yá Hádí*, O Guide, were at that time frequently on Akbar's lips.\* But as the child died six months later, 'Abdul Qádir took leave and went to Basáwar. Though he overstayed his leave, he was let off without punishment. On his return to Fathpúr, in 986, he presented the Emperor a short work entitled *Kitáb-ulahádís*, on the excellence of expeditions against infidels and the importance of practising archery. This book was 'Abdul Qádir's first work; for the translation of the *At'harban*, which, at Akbar's request, he had commenced as early as 983, had not been continued.†

The discussions on religious subjects were in the meantime continued at Fathpúr Sikrí with increasing zeal, and took a heretical character. In fact from 986 'Abdul Qádir ceased to look upon Akbar as a Muslim. He says in a remarkable passage (p. 255)—perhaps the most 'hostile' in his whole history—"His Majesty till now [986] "had shewn every sincerity, and had diligently been searching for "truth. But his education had been much neglected, and surrounded "as he was by men of low and heretic principles, he had been forced to "doubt the truth of Islám. Falling from one perplexity into the other, "he lost sight of his real object, the search of truth; and when the "strong embankment of our clear law and excellent faith (*millat i "baizá*) had once been broken through, His Majesty grew colder and "colder, till after the short space of five or six years not a trace of "Muhammadan feeling was left in his heart. Matters then became "different."

'Abdul Qádir from now felt uncomfortable at Court. The 'Ulamás to whose downfall he had contributed, were gradually banished to Bengal and Bhakkar; the Court was full of rabid Shi'ahs who openly in the State hall reviled the companions of the Prophet, and with heretical sophists who sneered at Muhammad, and turned th e

\* This passage has been translated by Sir H. Elliot, *Index*, p. 247.

† *Vide* Aín translation, p. 105, note 1.

Emperor's head with mysticism and pantheism. 'Abdul Qádir therefore withdrew to the background, and performed on *darbár* days the customary *kornish* (or salutation) from a distance. He used to take his place at the door 'where the shoes are left,' apparently an indifferent looker-on, but mourning in his heart for the contempt which Akbar and many of his grandees evinced for everything Islámitic.

In 987, 'Abdul Qádir had another addition to his family. He called his son *Muhiuddín* (reviver of the faith), without consulting the Emperor. In the same year he nearly lost his thousand big'hahs. Akbar, as related in the *Áin* (p. 270) had been busy in resuming the *Sayirghál* lands of the 'Ulamás, and had just deposed 'Abdunnabí, the Çadr of the realm, upon whom we may look as the last Çadr of the Moghul Empire in India.\* He personally inspected the documents detailing the grants held by the 'Ulamás, who had been ordered to come to Court. 'Abdul Qádir also was examined by the Emperor at Ajmír (Ramazán, 987). "I think," said Akbar, "his grant specifies the condition under which it is held." Qází 'Alí, by whom 'Abdul Qádir had been taken before His Majesty, replied, the condition was, that he should attend at Court. "Then has he been ailing," rejoined the emperor, "that he has been so often away without leave?" "No," said Ghází Khán, one of the courtiers that were present, "but his good luck has been ailing." Several others also interceded for him and desired the Emperor to leave him in possession of his grant, though the Imámship was abolished; for at that time the five daily prayers were no longer openly observed at Court, and 'Abdul Qádir's services were no longer required. When Shahbáz Khán observed, "He is always in attendance on Your Majesty," Akbar said, "I force no one to serve me; should he not wish to remain in attendance, let half the grant be resumed." As soon as 'Abdul Qádir heard this, he made a *salám*, as if he was pleased with the decision; but the Emperor was vexed and turned away his head. As the courtiers, however, again advised him not to let him go, Akbar issued no order, and 'Abdul Qádir retained his thousand big'hahs.

\* Historians have hitherto paid no attention to Akbar's gigantic struggle with the office of the Cadr. In this point, he resembles such Roman Catholic kings as successfully interfered with the property of the Church and monasteries. The *Jamnápúr Rebellion* of A. H. 987 (Bađ. p. 276) arose from Akbar's interference with religious matters and the almost ruthless manner with which he cancelled the grants of the Mullás.

Dissatisfied as he was with the religious innovations spreading at Court, poverty compelled him to remain with the emperor. But in 989, he again absented himself; and if it had not been for Abulfazl and Khwájah Nizámuddín Ahmad, the historian, he would have been dismissed. 'Abdul Qádir says (p. 296)—“ On the fifth Zí Qa'dah, 989, His Majesty returned from Kábul to A'grah. I had been absent from Court, and had stayed for a whole year at Basáwar, fettered by a deep attachment (*ta'alluq i khaṭire 'azím,*) a clear dispensation (*mazhare tám*) of the Almighty. Little caring for the world, I passed my time in spiritual independence; but I suffered much grief and sorrow. [This is the love affair alluded to on p. 124.] At last, on the sixth of the same month, I went to Fathpúr and paid my respects, when His Majesty asked Abulfazl why I had not accompanied him to the Panjáb.” “He belongs,” said Abulfazl, “to the grant-holders,” and I was let off. But before this, when the emperor was in Kábul, he asked one day Qadr Jahán to present all grantholders present in the camp, and draw up a list of such as were absent. When my name was read out among the absentees, Khwájah Nizámuddín Ahmad, with whom the year before I had become very intimate, very kindly reported me sick, which counted as present. And in reality, attendance on a person, before whom one stands in hope and fear, is worse than sickness. But the Khwájah wrote me letter after letter, asking me to go at least as far as Láhor to meet his Majesty, as I had been otherwise neglectful; and he reminded me that it was important to adhere to the formalities of the world. But an hour spent with the beloved appeared to me better than eternal life. What did I care about wisdom of going the ways of the world, and the interest and the disadvantage of others? I put my affairs into the hands of God; for after all, He does what He wishes.

Leave all thy cares to God, and live happy,

If thy accuser has no mercy, He will have compassion.

\* \* \* And even now [1004], after seventeen years, the remembrance of his lovely shape has not vanished from my heart. I cry as often as I think of him. Would that I had died in the wretchedness of my love grief!”

In the meantime, Akbar's Divine Faith' (*dín i iláhí*) had made much progress, and 'Abdul Qádir who had no longer to lead pray-

ers in the Mosque of Fathpúr, was commissioned to execute literary tasks; but inasmuch as these orders were connected with the religious views of the emperor, they were unwillingly and hesitatingly performed. The first task which was given him, was to assist in the composition of a historical work, to which Akbar beforehand had given the title of *Tárikh i Alf*,\* or History of the Millennium. The year 1000 A. H. was near, and Akbar had been flattered into the belief that he was the *Qáhib i Zamán*, or Man of the Millennium, through whose agency Muhammadanism was to be totally changed [Aín translation, p. 190]; and the object of the new historical work was to represent the religion of the Prophet as a thing of the past. The coins of the realm even were to announce this fact, and their inscriptions exhibited the mysterious word *alf*, or millennium. But as Akbar had engaged nearly every literary man at court to take part in the grand work, the narrative was tinged with the heretical and Shi'itic prejudices of the joint authors; and 'Abdul Qádir, who was a staunch Sunní, was soon called to account for certain facts which he had represented as having happened during the reigns of the early Caliphs. The Shi'ah account, it is well-known, of the events of that period differs remarkably from that of the Sunnis; and Akbar who rejoiced in any record which reflected discredit on Muhammadanism and the deeds and lives of the prophet and the apostles of Islám, naturally preferred Shi'ah accounts, soon relieved 'Abdul Qádir of his portion of the historical work which was to appear "By Authority," and entrusted the execution of it to Mullá Ahmad of T'hat'hah who, from all accounts, indulged openly at court in the most vehement abuse (*sabb o tabarrá*), which Shi'ahs cannot and will not suppress as often as they hear the names of 'Omar and Abú Bakr.† At a later period, however, [in 1002] 'Abdul Qádir, after the murder of the Mullá,‡ was ordered to revise the whole work after its completion; but knowing the propensities of the emperor, he limited his corrections to style and arrangement, without altering the party-coloured statements of the Shi'ah joint authors.

\* *Vide* Elliot's Index, p. 144.

† A Shiah once told me that 'Omar appeared to them more ridiculous than Abú Bakr. They often use phrases which occasion mirth and laughter among themselves, though a Sunní would not know what they are laughing at.

‡ *Vide* Baddóni, II, p. 392.

Nor was 'Abdul Qádir more fortunate in his translation into Persian of the Mahábhárat. Akbar even called him a *Harámkhur* (sweeper) and a *Shalghamkhur* (turnip-eater), "as if that was the share due to him for his labours," (*Áin* translation, p. 105, note 1.) At the same time, however, he was engaged in writing a Persian translation of the Ramáyan, which after four years' labour he finished. In Jumáda I, 997, he presented his work, after a second revision, to the emperor. "I had put," he says, "at the end of the translation the following verse by Háfiz—

I have finished my tale, who will take it to the Sultán?  
I have worried my soul, who will tell it the Beloved?

And this pleased His Majesty very much. He asked me how many *juz* [one *juz*=two sheets of paper] there were? "At first," said I, "there were about seventy; but after revising it, I got one hundred and twenty."\* "But you must write a preface to it," replied the emperor, "according to the custom of authors." But I had no inclination (*intí'ásh*) for it, as prefaces had to be written without the usual laudation (*na't*) of the prophet; so I shut my eyes, and did as if I assented. I take refuge with God against the consequences of composing this black book [the Ramáyan], which, like the book of my life, is nothing but wretchedness. Relating the words of unbelievers, after all, is not unbelief, and I earnestly denounce unbelief. \* \* \* A few days after, His Majesty was reminded that he owed me a present for my translation. He said to Hakím Abulfath, "Just give him this shawl here, and let him have a horse, and some money," and to Sháh Abulfath he said, "I give you the whole of Basáwar as *jágír*, and the grantholders there are also yours;" and mentioning my name, he said, "This man goes to Badáon; and having neither seen, nor heard any thing against him, I hereby transfer his grant from Basáwar to Badáon." \* \* \* As soon as I received the *farmán* specifying my transfer, I took leave for twelve months, and went to Badáon (p. 368).

This transfer, in 997, from Basáwar to Badáon is the cause why 'Abdul Qádir has been called *Badáoní*. On his return, in 998, from Badáon to Court, he met his friend the Historian Nizámuddín

\* From the number of sheets which Badáoní presented, it may be inferred that the translation was an abstract of the contents of the Ramáyan, not a translation.

Ahmad. During his leave, he intended to visit him in Gujrát, because as early as 993, he had been invited by Nizám, though he was prevented by circumstances from accepting the invitation.

Not long after, Badáoní was again engaged in literary labours. "The emperor," he says, "had ordered me (p. 384) to re-write the Persian translation of the History of Kashmír by Mullá Sháh Muhammad of Sháhábád, a learned man well versed in argumentative sciences and history. I was to write it in an easy style. This I did, and in the space of two months I presented my book, which was put in His Majesty's library to await its turn for reading." This order was connected, it appears, with Akbar's stay in Kashmír, from the 2nd Jumáda II to 2nd Zí Qa'dah, 997, when he returned by way of Kábul in the beginning of 998.

After revising the History of Kashmír,\* 'Abdul Qádir received a portion of the *Mu'jam ul Buldán*, which Akbar, at the recommendation of Hakím Humám, had given to ten or twelve people to translate from Arabic into Persian. Besides Badáoní, there were Mullá Ahmad of T'hat'hah, Qásim Beg, Shaikh Munawwar, &c.† These translations were made at Fathpúr Sikrí, "the old *Díwánkhánah* having been changed to a *Maktabkhánah* for the comfort of the translators" (p. 344). Badáoní finished his portion in a month, and presenting it to the emperor, asked again for leave, which was hesitatingly granted, though Nizámuddín represented that the leave was necessary, as Badáoní's mother had just died. But Akbar did not make him a present, as was usual on departure; "for Çadr Jahán, who had been appointed Çadr of the empire, told me to perform before the emperor the *sijdah*, or prostration; and when His Majesty saw that I was unwilling to do so, he told the Çadr‡ to let me off. But he was annoyed, and would not give me anything."

\* No copies have, till now, turned up of either Sháh Muhammad's History of Kashmír, or Badáoní's revision. Abulfazl in the *Aín* (p. 106.) says that Sháh Muhammad translated it from Kashmíri into Persian.

† No copies appear to exist of the Persian translation of this valuable Geographical Dictionary. The Arabic text has lately been published, in eight volumes, by Wüstenfeld at the cost of the Deutsche Morgenl. Gesellschaft.

‡ This worthy Chief Justice set a bad example in this regard to pious Muhammadans. Subsequently he became a member of Akbar's 'Divine Faith.' He also held office under Jahángír, and was exempted from performing the prostration, "because the Chief Justice of the empire could not well be forced to act against the law of the Prophet." (*Tuzuk*.)

'Abdul Qádir accompanied Nizámuddín to his jágir, the town of Shamsábád, from where ill-health compelled him to go to Badáon. Whether his ill-health continued or not, 'Abdul Qádir again overstayed his leave. He also appears to have taken away with him from Akbar's library a copy of a book entitled *Khírad-afszá*, which he lost on his way to Badáon; and though a collector of Salímah Sultán Begum (one of Abbar's wives)\* reminded him several times of the book, and his friends at court sent him several messages to Badáon, he was, as he says, unable to go (p. 377).

This annoyed Akbar. He cancelled Badáoní's grant, and ordered him to repair to court, to answer for his conduct. Nizámuddín and Abulfazl tried in vain to assuage the just anger of the Emperor.

During the time Badáoní enjoyed, at Court and in Shamsábád, the company of Nizám, he commenced his polemical work entitled *Najáturrashíd*, and his historical work entitled *Muntakhab uttarwárikh*. Of the former work, the title of which contains the *Tárikh* of its composition (999), I have seen two MSS. One—a bad one—belongs to the Asiatic Society of Bengal; the other, a very superior one—I extracted from a heap of 'rubbish' in the Delhi collection of MSS. belonging to the Government. The extracts below taken from this work, will shew that it is a valuable addition to our knowledge of the religious questions which were discussed during the tenth century of the Hijrah, and gives a complete account of the rise of the *Mahdawí* sect, to which Badáoní, though not perhaps openly, belonged.

\* *Vide* Proceedings, Asiatic Society, Bengal, for August, 1869, p. 213, l. 7, and p. 215, l. 11. Bábar in his *Wáq'át* says that he had three daughters—Gulrang Begum, Gulchihrah Begum, Gulbadan Begum (married to Khwájah Khizr Khán, Bad. II, p. 14). The *Tuzuk i Jahángirí* (p. 113) and the *Iqbál-námah* (p. 68) say that Salímah Sultán Begum was the daughter of *Gulrukh Begum*, who was a daughter of Bábar's. Does this imply that Bábar had four daughters? I consulted the two MSS. of the *Maásirul Umará* which are in the Society's Library, of which one is so excellent and correct, that it could be printed off without the assistance of other MSS.—an excellence rarely found among Indian MSS.; in fact I suspect, the book is an *autograph*. This excellent MS. says that Salímah Sultán Begum was the daughter of *Gulbang Begum*, but the inferior MS. reads *Gulrang Begum*. Perhaps time will clear up this confusion of names in the MSS. and our printed Historical texts. *Vide* my review of the *Tuzuk*, *Iqbálnámah*, &c., in the *Calcutta Review* for October, 1869, entitled 'Jahángir's Death.' I am convinced that as soon as the existing MSS. sources of Indian History have been used up, we shall see how limited and inaccurate our knowledge of the history of this country really is, as far as details are concerned.

Deprived as he now was of his income, Badáoní was soon forced to repent his carelessness and disobedience. He hastened to Akbar's camp at Bhambar, near the frontier of Kashmír, which he reached during the last month of the year 999 (p. 383). "Hakím Humám," he relates, "reported my arrival to His Majesty, and said, I was anxious to pay my respects. The Emperor asked, how long I had overstayed my leave. Humam said, for five months; and when the Emperor enquired after the reason of my absence, the doctor said that I had been ill, and that I had brought with me a representation signed by several nobles of Badáon, and also a certificate by Hakím 'Ain ul Mulk of Dihlí.

His Majesty read through the papers, and said, "No, this sickness does not last five months." He would not allow me to attend the darbár. So I had to run about in the camp which the Emperor left at Rahtás in charge of Prince Dányál, whilst he himself went to Kashmír. Lonely and sorry, disappointed and aggrieved as I was, I read through the *Hiçn i Haçín* [a famous prayer book used all over the East], and fortified myself by repeating daily the *Qaçidah i Burdah* till, at last, after five months when the Emperor returned from Kashmír, matters began to look up. He had expressed the wish to have a Persian translation of the great Historical work by Rashíd, entitled *Jámi'*, and some true and kindhearted friends, as Nizámud-dín and others, mentioned privately my name to His Majesty, and I was, at last, at Láhor allowed to attend at Court (17th Rabí' I, 1000)."

The state of Badáoní's mind whilst 'running about in Dányál's camp', may be seen from Faizí's letter of recommendation to Akbar, which, however, arrived too late. Faizí, in Shawwál 999, had been sent, on a political mission, to Rájah 'Alí Khán, ruler of Asír and Burhánpúr, and he had afterwards gone to Burhán ul Mulk of Ahmadnagar, to which place Badáoní, from Bhambar, had written, requesting him to intercede in his behalf. Faizí's reply was dated Jumáda I, 1000, at which time Badáoní was already restored. But 'Abdul Qádir shewed Faizí's letter at Láhor to Akbar; for he says that Akbar ordered Abulfazl to enter the letter, which is a model of a letter of recommendation, in the Akbarnámah.\*

\* Badáoní also gives a copy of the letter under his biographical notice of Faizí (III, 303). The letter has been (indifferently) translated by Sir H.

The translation into Persian of the *Jámí' i Rashídí*, part of which was done by Badáoní, was completed by other learned men of Akbar's Court under the 'superintendence' (*istiḡwáb*) of Abulfazl himself; but unfortunately no copies of it appear to be now extant, which is much to be regretted considering the comparative scarcity of MSS. of the Arabic original. [*Vide* Morley's Catalogue.]

Badáoní was thus restored to favour and the possession of his thousand big'hahs. It seems as if after his restoration, the religious feeling which his past misfortunes and exclusion from Akbar's Court had called forth, had disappeared and given way to levity and spiritual indifference. He may have found it necessary to assume a more conciliating attitude towards the 'heretics' of the Court, and the members of Akbar's 'Divine Faith,' who were in office and had partly brought about his pardon. He may have imitated the example of his friend Nizámuddín the historian, who, though a pious Muslim, managed to rise higher and higher in Akbar's favour by keeping his religious views to himself. But whatever the real cause of this inroad of worldliness may have been, Badáoní, towards the end of 1002, repented and thought it necessary to enter the fact in his history. "In this year," he says (p. 395), "I was punished by successive blows of misfortunes and lashes of adversity; but God created in me a new spirit, and led me to repent of the several wanton pastimes in which I had indulged, and the crimes which I had frequently committed against the orders of our Law. I acknowledge the viciousness of my deeds.

Elliot, Index, p. 256. The words on p. 255, 'He (Shaikh Faizí) is commonly called the "chief of Poets," but he was in fact a mere Poetaster', are not in Badáoní, neither in the printed edition, nor in the MS. which Elliot used. The *para.* on p. 256 commencing, 'He had composed poetry for forty years, &c.' conveys, in Elliot's version, an impression very different from what Badáoní intends to convey, and is diametrically opposed to another passage (II, 396) where 'Abdul Qádir clearly says that 'Faizí's *Nal Daman* is a *Masnawí* the like of which, for the last three hundred years, no poet of Hindústán, after Mír Khusráw of Dihlí, has composed.' The sentence which Badáoní pronounces on Faizí's poetry—and every one who has read even portions of Faizí's *Díwán* will agree with him—is that he is somewhat frigid, and deficient in that soft and plaintive sentimentalism of modern Persian Literature, compared with which the Byronism of England and the Wertherism of Germany are nothing. Faizí's thoughts are grand and striking, and his language is classical *de rigueur*; but his poetry is so full of *Shathiyát*, *Fakhriyát*, and *Kufriyát* (*vide* my 'Prosody of the Persians'), that "every one admires but no one remembers his verses." The extracts selected by Abulfazl of his brother's poetry in the *Ain* (at the end of second book) fully bear out what Badáoní says, and explain why Badáoní, though he censures, can yet warmly admire.

Oh that this frame of mind would last for ever—Alas!

And I saw a good omen in the word *istiqámat* (purity of intentions), by which I expressed the *táríkh* (1002) of my repentance. Shaikh Faizí also [who evidently felt amused at Badáoní's 'confessions'] favoured me with the following Arabic verse (metre *Mutaqárib*)—

*Laqad tába Shaikhí 'amilhaubaté\**

*Wa táríkhuhú sábiquttaubaté*

"My friend, the Shaikh, has now turned from his wickedness."

"And the words *Sábiquttaubate* (the old repenter) give the *táríkh*."

Badáoní adds, by way of explanation, (metre *Mujlass*)—

برفت از سرم اندیشه می و معشوق بشد ز خاطرم آواز بریط و طنبور

The love of wine and sweethearts has vanished from my brain.

And songs, and drums, and lyres, "enchant my heart no more."

Faizí in his letter of recommendation states that Badáoní was well up in the melodies of Hindústán and Persia (*naghmah i hind o wiláyat*) and knew how to play chess, two-handed and four-handed (*kabír o çaghír*), occupations which even now-a-days are looked upon as unlawful by orthodox Muhammadans, and which form the never-ending theme of discussion at their social meetings. In another passage also (III, p. 239), alluding to his former habit of composing love poems, he says that such poetry was current in the days before the Prophet, and that sincere repentance was better than such occupations.

Badáoní's 'repentance' was also connected with the loss of two of his friends. In the beginning of 1002, he buried Khwájah Ibráhím Husain, an *Ahadí*, to whom he was much attached (p. 394). The Khwájah, according to a statement by Bakhtáwar Khán,† was a calligraphist of great renown, and had been a pupil of Sultán Báyzíd, poetically styled *Mír Daurí*, whom Akbar had honoured with the title of *Kátib ul Mulk*. But a heavier blow befell Badáoní in the death, on the 23rd Çafar 1003, of his friend Nizámuddín, the historian. The fine passage which he devotes to the memory of his friend and to his own sorrow, has been translated by Elliot.‡ The

\* The final *š* counts as *و*, 400.

† In the most interesting chapter of his *Mir-át ul 'A'lam*, which contains biographies of learned men, calligraphists, and poets.

‡ Index, p. 185. In Sir H. Elliot's extract from the *Maásir ul Umará* containing the biography of Nizámuddín, p. 181, l. 11 from below, read, *Karí*

death of these two friends so affected Badáoní, that he resolved not to cultivate a new friendship with any other man and to look upon his bereavement as a warning from God. He says (p. 397, metre *Khafif*)—

مجلس وعظ رفتنت هوس است      مرگ همسایه واعظ تو بس است

Thou art anxious to listen to a good sermon :

The death of thy friend is a sufficient warning.

A few months later, Badáoní again attracted Akbar's attention. Two days before the 10th Rajab, when the Emperor celebrated the fortieth *naurúz* since his accession, on which day promotions used to be made, Akbar "sat at the window (*jharokah*) of the State hall, and called me; and turning to Abulfazl, he said, "He is a heavenly-minded, young man, with the air of the Çufí about him; but he is such a bigoted lawyer, that no sword is powerful enough to cut through the neck vein of his bigotry." Shaikh Abulfazl said, "In which book has he made the remark of which Your Majesty spoke?" "In this very *Razmnámah*,"\* replied Akbar; "and last night I asked Naqíb Khán about it." "Then," said Abulfazl, "he must have been very careless." I now thought it necessary to go close up to the window, and represented to His Majesty that I had strictly adhered to the duties of a translator; I had put down without alteration whatever the Pandits had told me, and I was ready to bear the consequences, should it be proved that I had put in words of my own. Shaikh Abulfazl took my part, and the Emperor remained silent."

"The passage in my translation of the Mahabhárat to which His Majesty objected, contains the last words of a dying Hindu sage, who advises all near him to give up carelessness, and only think of God: men should be wise and should not trust to knowledge acquired, but to good deeds done by them. Learning by itself was vain; men should refrain from doing wicked actions, *and ought to believe that every deed would once meet with its reward*—after which words I had put the following hemistich (metre Ramal)—

هر عمل اجرے و هر كرده جزائے دارد

for *Kathri*, and on p. 183, l. 2, read *Sháham 'Alí* for *Shahám 'Alí*. Nizámí finished his book in 1001, which Badáoní expressed by the word نظامی (1001),—a very happy *táríkh*.

\* Akbar had often the Mahabhárat, or *Razmnámah*, as he called it read out to him. From the above passage it seems that Badáoní in the portion which he translated, had entered, or was accused to have entered, a remark offensive to the religious feelings of the Emperor.

*Every deed has its reward, every act its recompense.*

“ These words [in italics] His Majesty thought referred to Islámitic notions of judgment, the day of resurrection, &c., in which he did not believe; for the transmigration of souls was his pet-idea. Hence he suspected me of having smuggled into the text something which he called *fa-qáhat*, ‘ Lawyer’s stuff.’ But I impressed upon some of the Emperor’s friends that every Hindu believes in rewards and punishments; in fact, they say that when a man dies, the book in which his deeds have been entered, is taken by the angel of death to the king of Justice, who compares his good deeds with his wicked actions, and then says, ‘ Let this man choose !’ The man is then asked whether he wishes first to be carried to paradise as a reward for his good actions, and then to hell for his bad deeds, or reversely. When the period of requital is over, he is sent back to the world and receives a body in accordance with the excellence of his former deeds; and so it goes on till by and by, he is freed from transmigration.

“ In this way I managed to get out of this difficulty.”

“ On the day of the *Sharaf* [nineteen days after the *Naurúz*], His Majesty said spontaneously to Çadr Jahán, “ Do you think, I can appoint Badáoní to the *Mutawallíship* of the tomb of Mu’in i Chishtí at Ajmír ?” The Çadr expressed his approval of this arrangement; and for two or three months afterwards, I attended every *darbár* in hopes of getting the appointment, by which I thought I would get rid of the miseries of Court life. I also wrote a few chapters and presented them, but got no answer. Soon after I was obliged to apply for leave \* \* ; and when towards the end of Ramazán, Çadr Jahán asked His Majesty for orders regarding my leave, the Emperor said, “ He has lots of work here, and I shall point it out to him from time to time. You better get another man for the vacancy [in Ajmír.] A few days later, His Majesty said to Abulfazl, “ He would do very well in Ajmír, it is true; but his translations give me satisfaction, and I do not like to let him go. Abulfazl and others agreed with the Emperor. On that very day I was told to complete the *Bahrul Asmár*, a book containing Hindú stories which at the command of Zainul ’Abidín,\* a former king of Kashmír, had been partly trans-

\* No copies of this curious work appear to be now extant. Zainul ’Abidín was a contemporary of Sultán Buhlul Lodí and Mírzá Abú Sa’id. Abulfazl says

lated into Persian. I translated the new portions within the next five months, all in all about sixty *juz*. Soon after, the Emperor called me once to his sleeping apartment, and asked me the whole night till dawn about these stories. He also ordered me to re-write the first volume of [Zainul 'Abidin's] *Bahrul Asmár*, because it was written in ancient Persian, no longer spoken, and told me to keep the MS. of the portion which I had made. *I performed the Zamínbos*, and commenced with heart and soul the new work. His Majesty also gave me ten thousand Muradí tangas [struck when Murád was born] and a horse as a present." (p. 402.)

Thus Badáoní, in all his Muslim pride, had to temporise, and performed the prostration.

Towards the end of the same year (1003), 'Abdul Qádir had to mourn over the death of two other friends, Shaikh Ya'qúb of Kashmír, known as poet under the name of *میرفی* *Çairafí*, and Hakím 'Ain ul Mulk, his old patron, who died at Hindiah, his *jágír*.

In the beginning of 1004, on the 10th *Çafar*, Faizí also died. The circumstances attending his death form the conclusion of Badáoní's History.

Our hero soon followed his heretical friend to the grave. Akbar may have granted him the leave which, in 1003, he was unwilling to give. He died at Badáon before the end of 1004, at the age of fifty-seven years.

The following particulars regarding Badáoní's death are of interest.

The *Khizánah i 'Ámirah*,\* a valuable MS. collection of biogra-

in the *Áin* that he had several works translated from Sanscrit into Persian—an additional example of attention paid by a Muhammadan ruler to Sanscrit literature. *Vide* Elliot's Index, p. 259, where on l. 18 we have to read *Mullá Sherí* for Mulla *Shabri*. So also on p. 251, of which the extract relating to the *Mahábharat* is so badly translated, that I cannot bring myself to believe that it was translated by Sir H. Elliot himself. For a correct translation, *vide* my *Áin*, p. 105, note 1.

As I mentioned the name of Sultán Buhlul Lodí, I may state that the correct spelling is Buhlúl. But in India, *Buhlúl* is generally pronounced *Buhlól*, with an *o*; in our Histories, the name is generally spelled Behlol. *Buhlúl* is Arabic, and means *graceful*.

\* MSS. of this work are rare. I possess a very excellent, almost faultless copy, which I lately bought, together with a copy of the *Sarw i Azád*, another similar though earlier work by the same author. Besides these two *Tadzkirahs*, there exists another by the same author entitled *ید بیضا* *Yad i baiza*, which was written before the *Sarw i Azád*. The latter work, the *Sarw*, contains valuable materials for a chronicle of the town of Balgrám, and extracts from (ancient) Hindí poetry.

phical and critical notices on the lives and works of Persian Poets by Ghulám 'Alí of Balgrám, as poet known under the name of *Azád*, has a short notice on 'Abdul Qádir of Badáon, in which the following sentence occurs—

صاحب ثمرات القدس کہ شاگرد شیخ عبدالقادر است سال وفات او  
سنہ ۱۰۰۴ اربع و الف نوشتہ \*

“The author of the book, entitled *Samrât ulquds*, who was Badáoní's pupil, says that 'Abdul Qádir died in 1004.”

The following much more valuable passage, translated into Urdú from the *Mukhtaṣir i sair i Hindústán* by Hakím Muhammad Wahid-ullah, was very kindly forwarded to me by Mr. A. S. Harrison, Bareilly College.

عبدالقادر بدایونی تخلص قادری پیش نماز اکبر بادشاہ کے تھے سنہ ۱۰۰۴  
ہجری میں وفات پائے چنانچہ تاریخ وفات شیفتہ شاعر نے لکھی ہے اور  
وہ قطعہ تاریخ یہ ہے \*

شاعرے خوشکلام و خوش افکار      زین جہان چونکہ ارتحال نمود  
از سر اشک شیفتہ آورد      قادری آہ انتقال نمود

سنہ ۱۰۰۴ چری

“'Abdul Qádir of Badáon, poetically styled *Qádirí*, was the Court Imám of the Emperor Akbar. He died in 1004, A. H. The poet *Sheftah* has expressed the *Tárikh* of his death in the following verse (metre *Khafif*)—

He is a poet of fine language and fine thoughts.

When he left this world,

Sheftah said under tears,

“Alas! Qádirí is dead.”

This is an example of a *Tárikh baṭaríq i ta'miyah*. The third *Miṣra'* literally translated is—Sheftah took from the beginning of اشك (*tears*), i. e., Sheftah added the letter *Alif*, with which *ashk* begins, to the numerical value of the letters of the last *miṣra'*, which gives  $1003 + 1 = 1004$ , provided we count آ as  $1 + 5$ , and not as ۱۱, i. e.,  $1 + 1 + 5$ .

The Urdu pamphlet, entitled *Tárikh i Badáon*, by Rái Bakhtáwar Singh, Sub-Judge of Gorák'hpúr (Bareilly, 1868,) gives on p. 83 the following particulars—

مولانا عبدالقادر بدایونی کہ اکثر کتاب تصنیفات انکی یادگار ہیں خلاصہ  
تواریخ (۹) و تاریخ بدایونی مزار اونکا متصل ابلاغ انبہ وقع سواد موضع  
عطاپور نواح بدایونمیں ہے \*

"'Abdul Qádir of Badáon, famous for his *Tárikh i Badáoní*. His tomb is close to the mangoe garden which lies in the environs of 'Aṭápúr, in the district of Badáon."

Mr. Harrison informs me that a gentleman in Badáon has been at some pains to discover among the numerous and decaying tombs in 'Aṭápúr the grave which encloses the remains of 'Abdul Qádir. But though his efforts have not been successful, it would be any thing but antiquarian sentimentality to continue the search for the resting-place of a man who has left us, if not exactly the fullest, yet the most original and independent history of the Great Emperor.

The conclusion of this paper will follow in an early issue. It contains extracts from Badáoní's *Najátturrashíd* regarding the *Mahdawí* Sect, in connection with which I shall make a few remarks on his character. Then follow extracts from the *Muntakhab*. My intention at first was to give in this paper Badáoní's remarks on Akbar's religion; but as the extracts have since been inserted in my *Áin* translation, I think it will be more advantageous to collect such passages as contain historical information not to be found in the *Akbarnámah*, the *Ṭabaqát i Nizámí*, and *Firishtah*. In collecting the *original* information from Badáoní's work, I have been guided by the excellent work, entitled *Sawániḥ i Akbarí*, a modern compilation by Amír Haidar Husain of Balgrám, the only *critical* work among the native Histories of India. I cannot in sufficiently strong terms recommend this book to Historians: it is a work that ought to have been long ago printed or translated.

The next article concludes with notes on Badáoní's style, the text of the *Muntakhab*,\* and a valuable collection of *Lectioes Variantes*, which Mr. J. C. Lyall, C. S., Balandshahr, kindly placed at the disposal of the Society.

CORRECTIONS &c. Page 110, *l.* 13 from below, and a few other places, read *Firishtah*, for *Farishtah*.—Page 116, last line. Add, 'since writing the above, a copy of the *Maásir i 'Alamgírí* has been bought by the Society.'—Page 117, *l.* 4. I am somewhat doubtful whether Badáoní means this *Todah*, or the *Todah Bhím* in the *Sirkár* of *Agrah*, and not very far from *Basáwar*, where B. spent his youth; *vide Áin* text, p. 356.—Page 120, *l.* 1, read *Putiyállí*.—Page 127, *l.* 3 from below, read [1004,] for [1005.]

\* Especially the very fair edition printed by Nawalkishor, Lucknow, 1864.

*The Nineteenth* (1) *Book of the Gestes of Prithiráj* by Chand Bardái, entitled “*The Marriage with Padmávati*,” literally translated from the old Hindi by JOHN BEAMES, *Esq.*, B. C. S.

I have selected this spirited poem as a first specimen of translation from the Prithirája Rásá, and it must be regarded solely as an essay in translation. Chand’s language is archaic, his dialect is as much Panjábí as Hindí, dating from a time prior to the definite separation of the two languages, his poetic licenses are numerous and daring, the texts of the only two manuscripts I have yet had an opportunity of thoroughly studying, are very corrupt, and I have no Pandit to help me. I rely chiefly on my own resources. I have, however, used with very valuable results, dictionaries of Panjábí, Sindhí and Gujarátí, and a glossary of the Marwáí dialect. Still much remains uncertain and conjectural, and I am open to any criticisms, and ready to admit that I may have made mistakes where “*tantum difficile est non errare.*”

*Book the Nineteenth.*

Here begins the marriage with Padmávati.

*Couplets* (दोहा)

1. In the eastern land there is a fort, lord of forts,  
Samud Sikhar, hard of access ;  
There lives a victorious hero, lord of kings  
Of Jádav race, strong-armed. (2)
2. With retinue, (3) horses, elephants, much land  
And dignity of a Padshah (पातिसाय रे मर्जाद)  
A mighty lord to all his servants  
With pomp and standards very splendid.

*Poem* (कवित्त)

3. With many (4) standards very splendid,  
Song and music playing five times a day,\*  
Mounting ten thousand horses  
With golden hoofs and jewelled trappings  
A lord of countless elephants,  
A valiant army thirty lakhs strong ;

\* At his palace gate, as is the custom with Indian princes.

- A sole ruler wielding Siva's bow,  
 Holding the earth in his sway.  
 Ten sons and daughters all told (5)  
 Chariots of beautiful colours very many,  
 Storehouses, countless millions of wealth  
 Had he, Padam Sen, the virtuous prince.
4. Padam Sen, the virtuous prince,  
 In his house was a wellborn dame,  
 From her breast a daughter sprung  
 Beauteous as a digit of the moon.
5. Fair as a digit of the moon,  
 Fairer than the whole sixteen digits;  
 In her childish guise she rivalled the moon  
 When he has drunk the *amrit* juice.  
 Like a lotus expanding through love of the moon-dew (6)  
 She had stolen from the deer the glance of its eyes.  
 She had [the beauty of] the diamond, the parrot and the *bimb*.  
 A pearl from head to foot, glittering like a serpent.  
 Her gait [was like] a prince, an elephant, a lion, or a swan (7)  
 She was endowed with a collection of all sorts of charms;  
 Padmávati was the highest type of woman (पद्मिनी)  
 Like an object of love created by Love himself.
6. Like an object of love formed by Love,  
 Formed in the perfection of beauty,  
 Fascinating beasts, birds, and serpents,  
 Gods, men, and saints likewise.
7. She had all the auspicious marks [on her body]  
 Well she knew the sixty-four arts, (कला)  
 She knew the fourteen sciences, (अङ्ग)  
 She was like the spring among the six seasons.
8. Playing about with her companions  
 In the gardens of the palace  
 Her eyes lit upon a parrot,  
 Then her mind was joyful.
9. Her mind was very joyful,  
 Expanding like a lotus in the rays of the sun  
 Her red lips thirstily opening,

Likening the beauty of the parrot to the *bimb*-fruit.

*She* strove [to catch it] with eager eyes, (8)

It resisted, fluttering and struggling ;

Avoiding its beak, she seized it,

Then she took it in her own hand.

Rejoicing with joy, pleasure in her mind,

Having taken it inside the palace

In a beautiful cage, inlaid with jewels

She was taking and placing it.

10. In it she was taking and placing it ;  
Went to play, forgetting everything,  
Her mind slipped away from the parrot  
Joyfully calling " Rám, Rám."

11. The parrot seeing the beauty of the princess,  
This form from head to foot,  
This finished work of the Maker,  
This peerless model of a woman.

*Poem कविज्ञ.*

12. Wavy tresses fair to see,  
Rivalling the dawn, with a voice like the *Koíl* ;  
Fragrant as the blowing lotus,  
Swan-like her gait, slow-paced.  
White-robed, her body shines,  
Her nails are drops of Swáti [pearls] ;  
The bee hums round her, forgetting his nature  
In the flavour and fragrance of the god of love.  
The parrot looked with his eyes, and was pleased—  
[Said] " This beauteously moulded form  
" My Lord Prithiráj shall obtain  
" Forestalling Hara, the joy of Umá."

*Couplets.*

13. Approaching the parrot, the princess  
Applied her mind to speak to it.  
It was a very accomplished Pandit-parrot  
" Who spoke words distinctly.

*Arill metre.*

14. She asks with soft and gentle voice

Saying " O parrot, tell me true,  
 " What is the name of your country ?  
 " What king rules there ?"

15. Quoth the parrot, hearing the speech,  
 " Dillí Garh, the abode of Hindús,  
 " There is the incarnation of Indra, the Chahuwán,  
 " There is Prithiraj, the mighty hero."

*Paddharí metre.*

16. To the princess Padmávatí  
 He tells the tale again very clearly,  
 In the place of the Hindus, the best of lands  
 There rises the fort of Dillí, fair to see.  
 The lord of Sambhari, the land of the Chahuwan,  
 Prithiraj there rules gloriously.  
 Sixteen years of age, a king,  
 A long-armed monarch, a lord of the people.  
 Lord of Sambhari, son of Somesar  
 God-like in form, a very incarnation.  
 Nobles and heroes all unequalled  
 With arms like Bhím, powerful as Yama ;  
 Who took the Pakkari Shah Sahab  
 Three times they stopped him and turned him back.

[Here a doubtful line.] (9)

His word never fails, his arrow is piercing,  
 Mighty his voice, death-dealing his hand.  
 With seven thousand virtues like Hari Chand,  
 Brave and strong, a hero like Vikram,  
 Among the Dánavs an incarnation, merciful  
 Over the four quarters of the earth a king, skilled in all arts  
 An incarnation of Kandarpa himself.

*Couplets.*

17. An incarnation of Kamdev is he  
 The king, Somesar's son ;  
 Scattering a thousand rays on the lotuses  
 Like the sun, a guardian of mankind.
18. Hearing the account of the glory of Prithiráj  
 Transported with child-like joy,

Body, soul and thought fixed on the Chahuwan,  
She remained, blushing red.

19. All her moon-like appearance passed away,  
Her end approached ;  
Mother and father were anxious,  
Seeking for the maiden a husband.

*Poem.*

20. Seeking for the maiden a husband,  
They made enquiry on all sides ;  
They got Brahmins and Gurus, speaking,  
Telling, and explaining that matter,  
“ A man, a king, a lord of men,  
With a large fort, inaccessible, immense,  
Accomplished, of pure race,  
Give to the princess, O king !  
Then send a Brahmin to make the betrothal,  
Virtuous, praiseworthy, as thyself ;  
[Let there be] joy and gladness in Samud Sikhar,  
Singing of songs, flags many.”

*Couplets.*

21. To the North, in the Sawálikh hills  
In the fort of Kamáún, hard of access  
Rules a king, like the jewel in the lotus,  
With horses, elephants, wealth endless.
22. The Brahman prepared the cocoanut fruit  
Having filled the *chauk* with pearls and (other) jewels,  
That the hero should pledge himself to the maiden  
With great joy making the alliance.

*Bhujangi metre.*

23. Smiling the king took the betrothal offering,  
For joy from door to door the drums were beat ;  
The lords of forts all speaking, agreed,  
All the kings of that family arrived.  
Came ten thousand horsemen renowned,  
Thirty-three thousand foot soldiers filling the place,  
Drunk with the moisture (from their temples) five hundred  
elephants

Like black mountains moving on earth, rank on rank.  
 Came glittering like fire mingled with ice,  
 Eighty-four horses, powerful and strong.  
 With incomparable necks and hoofs, prancing and rearing. (10)  
 Of the five colours, shaking their trappings.  
 (There was) playing of instruments in five tunes,  
 [A doubtful line (11)]  
 In Samud Sirsikhá (12) there was shouting for joy  
 The marriage hall was adorned with garlands.  
 The noble maiden, Padmávatí, seeing the time (approach)  
 Spoke to the parrot this word, being alone.  
 "Quickly go thou, parrot, to the fair land of Dillí,  
 "Bring hither the hero, the Chahuwan king.

*Couplet.*

24. "Bring thou the Chahuwan hero,  
 "First tell him this message from me,  
 "While the breath remains in my body  
 "My beloved (shall be) Prithiráj the king."

*Poem.*

25. Beloved Prithiraj the king,  
 Fitly having written a letter, she gave it,  
 Arranging all the words of the invitation,  
 On the twelfth of the moon he took it.  
 Eleven hundred and thirty  
 Sákh era truly,  
 Thus;—"Khatti of pure race !  
 "Hero ! save a maiden's life ;  
 "On seeing this arise at once, O hero !  
 "Delay not for one instant.  
 In the space of five nights and days  
 "(Come) thou as Krishna came for Rukmini."

*Couplets.*

26. "As Krishna to Rukmini,  
 Thus, hero, lord of Sambhari !  
 On the western side of Siva's temple  
 At time of worship, be present."  
 27. Taking the scroll the parrot went,

Flew through the air like the wind ;  
 To where in Dillí, Prithiraj the king ;

\* \* [defective line.] \* \*

28. He gave the paper into the king's hand  
 Opening, read it Prithiráj ;  
 Seeing the parrot, he laughed in his heart,  
 Made preparation for going.

*Poem.*

29. That very hour, that very instant,  
 That very day, that very time, preparing,  
 All his heroes and nobles  
 He took, shouting " Boli bam."  
 Mention also\* Chand, the incomparable poet,  
 The hero perfect in beauty,  
 And his army, all its cohorts,  
 A valiant army, thirty lakhs strong.  
 To Chámanḍ Rai, the land of Dillí  
 And the fort, the lord of forts having given in charge ;  
 Away went king Prithiráj then,  
 Went away to the eastern land.

*Couplet.*

30. On the day the marriage procession went to Síkhar,  
 On that day went Prithiráj ;  
 On that very day to the Padshah  
 Came at Gajjanain (13) the report.

*Poem.*

31. Hearing at Gajjanain the report,  
 Arose the hero Sákábdín,  
 Of Khurásán, and Multán,  
 And Kábul itself the ruler.  
 A terrible warrior in the clash of battle,  
 A king with arms heavy as steel  
 The earth shook (beneath him), Seshnág fled,  
 In the sky the sun was hidden, it became night.

\* कथञ्च evidently an imperative ; we must suppose the poet to be addressing his muse, or to take a lower view of the case, perhaps he wanted a rhyme for लषञ्च in the next line.

Turning aside streams, like the Sindhu river,  
Stopping the way, standing foremost.

At that time to Raja Prithiráj

Chand spoke on this wise.

[What he said is not recorded.]

32. Seeing that the city was close at hand,  
The hero advanced without fear.  
In Samud Sikhar there was a great noise,  
The sound of drums on all sides.  
The poet went before as a guide,  
Having prepared a horse for the princess (14)  
To see them, all the women  
Mounted to the windows and balconies gladly.  
The princess looked forth from her dwelling,  
Looking like the shadow of Ráhu, (15)  
Peeping out at the window every moment,  
Watching for the coming of the Lord of Dillí.

*Paddhari metre.*

33. Watching the road in the direction of Dillí,  
Happy was she when the parrot returned.  
Hearing the news, glad were her eyes ;  
The maiden was elated with the tokens of love.  
She tore off the dirty clothes from her body,  
Purified, and anointed, and adorned herself with robes. (16)  
Called for priceless jewels (for her person) from head to foot  
Arrayed with the tokens of the king of love.  
Filling a golden tray with pearls,  
Lighting a lamp she waved it round. (17)  
Taking her confidante with her, boldly the maiden  
Goes as Rukmini went to meet Murári ;  
Worshipping Gaurí, revering Sankar ;  
Circumambulating (18) and touching their feet.  
Then on seeing King Prithiráj,  
She smiled bashfully, hiding her face through shame.  
Seizing her hand, putting her on horseback,  
The King the lord of Dillí took her away.  
The rumour spread that, outside the city,

They are carrying off Padmávati by force.  
 Drums are beat, there is saddling of horse and elephant,  
 They ran, armed, in all directions.  
 "Seize! seize!" shouted each warrior.  
 Rage possessed the heroes and their King.  
 Where King Prithiraj was going in front  
 With all his army behind him,  
 There the horsemen advancing arrived;  
 King meeting king, the warriors joined battle.  
 When Prithiraj the King turns rein,  
 The heavens stand still, the world-serpent shakes.  
 The chiefs and heroes all look (awful) as death,  
 Eager for blood on rushes the King.  
 The bows let fly countless arrows,  
 The deadly blades draw blood;  
 From the sweat of the wounds of the heroes on the field,  
 A thick stream flows, and dyes the sand.  
 As the warriors of the *barát* smote.  
 On the field fell heads and headless trunks of the foe.

*Couplets.*

34. The foe fell on the field of battle;  
 Turning his face towards Dilli,  
 Having won the battle, went Prithiraj,  
 All the chiefs were glad.
35. He took Padmávati with him.  
 Rejoicing, King Prithiraj.  
 Thereupon of the Padshah's  
 Arrival, there came a rumour.

*Poem.*

36. Of his arrival there was a rumour;  
 Came Sáhábdín, the hero,  
 "To-day I will seize Prithiráj,"  
 Said the Chief, loud shouting.  
 Countless warriors raged for the combat;  
 The army formed in line;  
 With arrows, javelins, and spears,  
 Catapults, (19) all arranged.

Throwing as it were mountains of iron.  
 The strong-armed lords of elephants met.  
 On they came shouting, ha ! ha !  
 The army of Khurásán and Multán.

*Paddhari metre.*

37. The lord of Khurásán, Multán and Kandahár,  
 With powerful sword, and unerring arrows.  
 Rohillas, Firangis (20) with long beards,  
 Crowds of Biloches with blazoned shields,  
 With cat-eyes, and slavering jackal-mouths ;  
 Thousands on thousands, powerful warriors,  
 On the backs and flanks of their horses saddles and housings.

\*            \*            \*            \*            \*

\*            \*            \*            \*            \* (21)

Dense masses of iron, and waving horse-tails,  
 Irákís, Arabs, Tázís swift for victory ; (22)  
 Turkís wielding mighty bows and arrows.  
 Such sword-handling troopers in crowds.  
 Though demons opposed them, they would not avail aught. (23)  
 In their midst, Sultan Sáháb himself,  
 Such was his army as described in song (24)  
 Him Prithiráj, the King surrounded,  
 On all sides with standards, and noise of drums.

*Verses.*

38. With noise of drums, and with flags,  
 (Came) the Chauhán Rána on all sides ;  
 All the chiefs and heroes,  
 Called to mind their potent spells.  
 Prithiráj the King set on,  
 The hero shook his reins with eagerness,  
 Drawing his sword full swift,  
 Strokes, quick as lightning, he struck.  
 The gods stood curious in the sky.  
 Drowned in blood (24) the earth was (one) stream :  
 Hara rejoiced at the sacrifice (26) of heroes.  
 At the shouts of the monarch and his host (27)

*Couplets.*

39. At the shouts of the monarch and his host ;  
 The battle was very fierce,  
 [An obscure line] (28)  
 Neither yielded, neither conquered.

*Verses.*

40. None gave way, none conquered,  
 Heroes and warriors stayed or fell,  
 On the earth they fell in numbers.  
 Making a very terrible fight.  
 Here were trunks, there heads ;  
 There hands and feet scattered wide ;  
 Here shoulders cleft by the sword,  
 There heads and breasts cut open at a blow. [hoofs.  
 Here skulls (with their) teeth and foreheads crushed by horse  
 Elephants' trunks and bodies likewise :  
 When the Rána of the Hindus, with sun-like face,  
 The Chauhán, grasped his sword.

*Bhujangi metre.*

41. The Chahuwán, the Hindu Rána grasped his sword,  
 Rushed on the troop of elephants like a lion in his wrath,  
 Severing heads and bodies, cleaving brows in twain,  
 All the chiefs and heroes utter loud shouts.  
 Shrieking and screaming in confusion they fled,  
 Abandoning pride and shame, and begging for mercy.  
 The elephants fled blindly, the Chahuwán overthrew them.(29)  
 Surrounding them on all sides he turned them.  
 The sun went down, (3) around was dark night,  
 (The army) went searching (for the road) nothing was visible ;  
 Leaning his head on his bow stood Prithiraj the King,  
 Then he seized the Sháh, who risked death and disgrace,  
 He took him away quickly having routed his army.  
 There fell chiefs five hundred there in the field outright. (31)  
 Rájputís fifty were disabled in the fight,  
 The song of victory was sung with flags and with beating of

*Couplets.*

[drums.

42. Victory was to Prithiráj ;

Taking the captive Sháh with him :  
 Towards Dillí he went,  
 Crossing the passes, the mountains and the Ganges.  
 With the fair Padmávati,  
 And the Ghorí Sultán.  
 Reached the city of Dillí,  
 The mighty-armed Chauhán.

*Verses.*

44. The Brahmins spoke and affixed the nuptial mark,  
 Selecting (32) a fortunate moment,  
 Made a bower of green bamboos,  
 Adorned with clusters and garlands (of flowers).  
 The Brahmins recited the Vedas,  
 The *homa* sacrifice [was performed] on a platform before the hero.  
 Padmávati was the peerless bride ;  
 The bridegroom, Prithiraj, king of men.  
 He fined Shah Shahabdí,  
 Eight thousand pieces of gold,  
 Having conferred gifts and rewards and dresses of six pieces (33)  
 The king went up into his fort.

*Verses.*

45. King Prithviraj went up,  
 Having released the hero Shahabdin :  
 The King, his chiefs and warriors ;  
 With banners, and music, and shouting.  
 [Moon-faced, deer-eyed women,  
 Preparing golden dishes many  
 Binding on pearls, joyously,  
 Forming in a ring men and women all,  
 Sang with joyful throats ;  
 Waving *chumris* from hand to hand,  
 With coronets on their heads.] (35)

*Couplets.*

46. The King ascended to the royal fort.  
 The virtuous King, Prithiráj  
 With very great and exceeding joy.  
 The crown of the head of the Hindús.

Here endeth the nineteenth chapter in the Gestes of Srí Prithiraj, composed by Srí Kavi Chand Bardai, entitled the seizure of Padmá-vati in the fort of Samud Sikhar by Srí Prithiraj after a fight, and the fight between Srí Prithiráj and the Padshah, and the victory of Srí Prithiráj and the capture and release of the Padshah. 19. Finished.

*Notes.*

(1) In Tod's MS. the 20th. In the Agra MS. it is misplaced and occurs as the 24th, but in this MS. the whole of the Mahoba Samyo to which it is introductory, is omitted ; as it is also in Caulfield's MS.

(2) Tod महाभुग which I have translated 'strong armed भुग = भुज. Agra has अभंग which agrees neither with rhyme or metre.

(3) हसम, حشم, retinue, attendants.

(4) Tod घन, Agra घुनि.

(5) Tod कह समस्य; Agra यिक हसम which makes no sense.

(6) Tod विसमसर, which is unintelligible ; Agra विगमसर, ditto. I read अमृत समर, *i. e.* अमृत के समर (-प्रेम) से, conjecturally.

(7) I read these lines thus ब्रह्मपति गयं केहरि हसं गति ॥ विहवसाय संचै सचीय ॥ Tod and the Agra MS. read गयंदहरि which gives no sense ; विहव I take to be for विश्व ; the substitution of *h* for *s* is a Panjábí characteristic frequent in Chand ; साय is for साया. The other reading विह बनाय I can make nothing of.

(8) चष चक्रित, with eyes rounded like a disc (चक्र), *i. e.* widely opened.

(9) Tod and Agra सिंगनि सु सद्गुन चढि जंजरि ॥ the meaning of which is not clear to me.

(10) The translation of this and the preceding line is purely conjectural the MSS. have entirely different and irreconcilable readings.

(11) सहस संहनाय विग मोहि राज' Tod. Agra has सहसं सहं, etc.

(12) In this time the proper name of the place is given for the first time. The fortress is identified as Sriswagarh on the Pahonj not far from Kunch " in Eastern Bundelkhand. Elliot's History of India, vol. ii. p. 459.

(13) Ghaznín.

(14) Readings vary in the different MSS. That translated above is the only intelligible one.

(15) The princess when in health was compared to the moon, when sick she is likened to the moon under an eclipse, caused as the Hindus believed by the demon Ráhu.

(16) Here again I have constructed an intelligible reading out the varying and obscure versions in the MSS.

(17) This is an allusion to the ceremony called *ártá* or welcoming the bridegroom.

(18) The ceremony of *pradakshinam* or walking round an object to be revered, keeping the *right* side always nearest to it.

(19) Tod and Agra तुपक तीरह सब सज्जीय, I at first translated this "muskets and arrows," but arrows have already been mentioned in the line above (बान); and it is very doubtful if guns and gunpowder could have been known at that early age, moreover the next line speaks of throwing mountains of iron; I therefore suppose some sort of heavy machine for throwing stones or darts, such as a catapult or mangonel, is intended.

(20) The mention of Feringhees here is curious. If the blazoned shields in the next line, the heavily caparisoned horses and iron armour apply to them, we might almost suppose some band of old crusaders had found their way eastwards! I suspect the whole passage however to be a modern interpolation. The word translated "beards" is मसानी which is found in no dictionary. I connect it with the Sanskrit मसु, Prakrit अस्सरो Sindhi मसु,—It is merely a conjecture however.

(21) These two lines are a puzzle. They stand thus—

फिरंगीकतीपाससुकलानलालं ॥

तहांवाघवाघंसरीरंकारो ॥

सुकलान is probably Persian سقلاط scarlet cloth, and I should like to read तोपा for तीपा, so as to make it descriptive of scarlet caps, which were distinctive of the Mughal cavalry, as in later times of the Kizilbash their descendants. The second line I give up entirely, as it stands at present.

(22) I read फती तेज ताजी, فتح تيز تاجي, the MSS. both have पटी.

(23) In both MSS. भिरे भूत जेते सु तेते अमोलं, i. e. जितने भूत उनसे भित्ते सो तितने अमूल (= निर्बल) होते ॥

(24) जप strictly, means 'muttering prayers,' but Chand uses जंप and जाप for chanting verses, or even for speaking.

(25) रगन सगन = रक्तमग्न. (26) जग्गे = जग्य *i. e.* यज्ञ

(27) I read ऊर करन गन वरन वर *i. e.* गन (= गण) अरुवरो के वर हर करने से (ऊलास ऊआ) वरो वर, hero of heroes, monarch, leader.

(28) निसवासुरसमुभिनपरत the meaning of which is not evident, nor how the words should be divided.

(29) This line varies in the two MSS. Tod has बिट्थै देरिग राज सु आन केरो ॥ Agra दैरे गज अन्न चडवान केरो ॥ I adopt the latter with the change of the last word to केयाँ No verb केना exists in Hindi, but in Sindhi there is केरणु to overthrow, cause to fall, and केरणा is used in Panjabi in the sense of scattering.

(30) Both MSS. have डडि which is absurd. I propose to read बुडि which is the earlier form of डवि, as the *setting* of the sun and not its rising must be meant.

(31) I read with Agra परे सीर से पंच तहां पेत चौज. This last word only occurs when a rhyme is required for चौज; it would seem to be connected with Hindi चौज (Sansk. चौच्च), clean. I look on it as an expletive and translate it 'outright.' Tod's version of this line is unintelligible. The whole of this Bhujangi is very corrupt. The Agra leaves out three whole lines and patches up a fourth with part of one line and part of another. It differs also entirely in some lines from Tod, but oddly has rather the better readings of the two.

(32) The word translated 'selecting' is परडीय, which is for परठि participle of a verb परठनै, the last syllable lengthened *metri gratiā*. It occurs once before in this book at stanza 22, where I have translated it 'prepared.' It is probably the Sanskrit प्रतिस्था, which would be in Prakrit पडिद्धा, whence परिठा and परठं. Chand is not particular about ड and र; thus we have परत for पडत, जुर for जुड, etc. The meaning would be to fix, settle, arrange, place, apply, etc. cf. Benfey *s. v.* स्था, also Bopp. Gloss. Comp. ib.

(33) षडभेष, lit. 'six dresses.' I suppose this to mean dresses of honour, as we should say 'khil'ats of six pieces.'

(35) The whole of this passage in brackets is omitted from the Agra MS., and I think it is an interpolation. The style is different from the rest, and it is somewhat out of place in the story. Moreover the last line of 44 is repeated in the first line of 46, as well as in the beginning of 35, which is unusual. The sixth line is partially unintelligible to me.

Persian and Arabic words in this book are *hashm, hazár, mahal, bágh, zanjír, áwáz, jang, fauj, khás, mír, tír, nishán, saklát, fath, tez, aswár, bází, sultán, tegh*; these occur chiefly in the passages relating to the Musalmán troops.

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PART I.—HISTORY, LITERATURE, &c.

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No. IV.—1869.

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*Translations from Chand.*—By F. S. GROWSE, Esq., M. A., B. C. S.

The two specimen translations from the *Father of Hindi Poetry* which I have submitted to the criticism of the Society, were, I believe the first that had appeared since the year 1838, when Col. Tod contributed to the *Asiatic Journal* a version of the *Kanauj Khand*. I have lately had an opportunity of comparing his translation with the original, and find that notwithstanding its apparent close adherence to Indian modes of expression, it is in fact extremely loose and untrustworthy; though no doubt it contains many suggestions calculated to smooth the path of a future translator. Considering the novelty of my undertaking, the comparative failure of my only predecessor, the inherent difficulty of the text, and the imperfect condition of the MS. in my possession, I felt little confidence in the result of my labours, and would gladly have welcomed the suggestions of competent critics. I was also in great hopes that such suggestions would not be withheld, since it appeared that the poem had recently excited considerable curiosity among oriental scholars. In these expectations, I have been completely disappointed, and the accuracy of my rendering has remained altogether unchallenged, from the indifference of the public, I fear, rather than from any more flattering cause.

I learn, however, from the September Proceedings of the Society that Mr. Beames (to whom the Philological Committee have entrusted the task of editing the complete poem) has prepared a separate translation of another canto, and has published a short specimen of it. It so happens that the portion selected is contained in one of my MSS. I have referred to it in my second paper, vol. 38, page 4. So far as I can judge from the English, the text used by Mr. Beames coincides closely with mine; but our views on the interpretation of many passages are far from coincident, as I will shortly proceed to shew.

I wish in the first place to reproduce the original text. This will occupy no great amount of space, since the passage in question consists only of 40 lines; and so very little of the text has ever yet appeared in print that many to whom MSS. are inaccessible may be glad to have a further specimen of it. Mr. Beames too will thus be able to see at once where difference of rendering is due to difference of reading. To the text I will append my own translation and subjoin a few notes, more especially at the points of divergence.

I am aware that it is much easier to detect flaws in another man's work, and to avoid them in rebuilding on the same plan than it is to succeed in constructing on an independent basis; but I cannot be justly impugned for essaying only the inferior task, since two of my own attempts already published are equally open to adverse criticism, and I propose to conclude this article by adding a third to the series. It will be, I hope, by a stringent examination of them that Mr. Beames will repay me in kind for my strictures on his performance.

Here follows the text of Mr. Beames' translation, as it stands in the Mainpuri MS.

दोहा पूर्वदिसिदिसिगढनिपतिसमुदसिखिरिअतिदुर्गा  
तहाविजैसुरराजवृषजिहिकुलमहिमाभुर्ग  
सहसनुहयगयदेशपतिपतिसादरमरजाद  
प्रवलभूपसेवहिसकलघननिसानवहुनाद  
खप्पे घननिसानवहुनादसूरसजेवजेदिन  
दशहजारहयचठतहेमनगजटितसजिततन  
गजअसंखिहयसंखिसमरसेनातिलखह  
एकएककरपत्रएकमरजादहरखह  
दसपुत्रएकएकहसुरयसुरगंडमरसुघर

	भंडारलक्ष्मिनिगतवहुतपदमसेनिकुअरहसुघर	10
दोहा	पदमसेनिकुअरहसुघरताघरनीसुसुजान	
	तिहिसुएकपुत्रीसुघरमनहुकलाशशिभान	
कपे	मनहुकलाशशिभानकलासोरहपरिमानं	
	वालवैससिसुतासमीरआमीरसमानं	
	विगसिकमलधमिधमरनैनपंजनमृगगोती	15
	होरकीरअरहंसमानुकातभपजोती	
	त्रिविधअंगअंगहजटितहयगयरथसोसरसविद्य	
	पदमसेनिसुवनहपदममनहुकामकामिनिरचिय	
दोहा	मनहुकामकामिनिस्थीसचोरूपकीरासि	
	पसुपक्षोमृगमोहनोसुरनरमुनियरआसि	20
	सामुद्रिकलक्षणसकलचेंसठिकलासुजान	
	जानुचहूदिशिअंगघटिरितुवसंतपरिमान	
	सखिनसंगखेलतिहसतिमहलनिवागनिवास	
	तहंकोरुदेष्टौनयनमनअतिभयौहुलास	
कपे	मनअतिभयौहुलासविगसिजनुकोककिरनिरवि	25
	अरुणअधरअसधरतविंवफलजानिकिरनिगवि	
	वहचक्षातवहचकितलखतितवअतिउरोजउर	
	चितुचहुयौअतिलोभलयोतवगहिजुअप्पुकर	
	हर्षितअनंगरखतिमनहिरहसिमहलभोतरगई	
	पिजरअनेगरतननिजटिततामैलैराखतिभई	30
दोहा	तामैलैराखतिभईगयोखलुसवभूलि	
	चितुचहुयोअतिलोभसोरामुपढावतिफल्लि	
	कीरमुदिननिरखेवदनसुखीमहामनहूल	
	करताकरीवनाइकेंयहपद्मिनिरसफूल	
कपे	कुंतलकेशसुदेशपीकरंचकअधरदस	35
	कमलगिद्ववैसंधिहंसगतिचलतिमदनरस	
	नवसतसोभसरीरमत्तिनगधंतिगुथिअस	
	नैननिरपिसखुपादमदनस्रतिसानौवस	
	परसेजुउमाहरहरिहितमिलैराजप्रथोराजवर	
	इमिजपैचंदुवरद्विथामहुलताअतिकलपतर	40

## NOTES.

Line 1. The second *disi* may be taken with the preceding words as a preposition meaning 'towards;' or with the following words as

the first number of a compound, *disi-garh-nipati*, 'lord of all forts on earth': the former seems preferable.

2. *Bijai* certainly may mean 'victorious,' but I think it better to regard it as a proper name. *Bhurga* is a word I have never met elsewhere; it may be for *bhúgat*, 'spread through the world;' but more likely for the Sanskrit *bhrísa*, 'extensive.' Mr. Beames may have *Jádav* for *jihi*; but whence he obtains his epithet 'strong-armed' I cannot conceive. Is it intended as a rendering of *mahimá bhurga*?

4. *Sevahi*, which Mr. Beames takes to be a substantive, is clearly a verb. He also confuses the Hindi *nisán*, 'a kettle drum,' by no means an uncommon word, with the Persian *nishán* 'a standard.' One would have thought the epithet *bahunád*, 'loud sounding' was a sufficient guide to the true meaning. To translate *bahunád* by 'very splendid' is decidedly original.

5. Here *din* must stand either for *din prati*, 'every day,' or for *din bhar*, 'all day;' I can see no reference to 'five times a day.'

6. Nor here to 'golden hoofs;' can Mr. Beames have taken *nag* for *nakh*?

7. Mr. Beames has entirely omitted the words '*hay sankhi*.'

8. Apparently Mr. Beames has wrongly divided the words, thus getting *har* at the end of the line, and then seeing the words *kar* and *patra*, has jumped to the conclusion that some reference is intended to *Har's*, i. e. *Sivá's*, bow; the real meaning is something quite different.

9. The text speaks of ten sons only, no daughters: and the meaning is, not that Padamsen had ten sons, but that he was one of ten brothers.

12. 'From her breast a daughter sprung.' This is rather awkward English, and not at all required by the original, which literally translated is, 'she had one fair daughter.' Nor in the preceding line is there any mention of 'house:' apparently either *sughar* or *gharni* has been wrongly divided. The word *bhán*, 'the sun' has been totally omitted.

14. The words in this line should be divided thus: *Bál vais sisutá samir*: evidently Mr. Beames has split them up into *Bál vai sasi sutá*, but even then they cannot bear the meaning he gives them. *Vais* is for *avasthá*.

15, 16. These lines are difficult, but not corrupt. The emendation suggested by Mr. Beames, in his translation since published is quite unnecessary. Even with such emendation, the words could not yield the sense he gives them.

17-20. The first of the two couplets here omitted by Mr. Beames is certainly extremely obscure; the second is simple enough.

22. Mr. Beames's rendering can scarcely be correct; since the Hindus reckon not fourteen but only six sciences.

23, 24. These lines are somewhat remarkable, as being the only two out of the forty which Mr. Beames has translated with absolute accuracy. Certainly they are not very difficult.

26. The comparison is not between the parrot and the *bimb*, but between the *bimb* and the girl's red lips.

27. The words *uroj ur* are altogether omitted.

28. Nothing in my text about 'avoiding its beak.'

31, 32. Here Mr. Beames omits much and exactly reverses the sense of what he retains.

35. *Sudes* must mean 'well arranged,' not 'fair to see.' The latter half of the line has nothing that corresponds in the slightest with Mr. Beames's translation.

36. The difficulty here is evaded. The reading of my text '*giddh*' must I think be corrected to '*biddh*.' *Bais-sandhi* is an uncommon expression, but is thus explained in the *Sringar-saurabh* :—

Bálápan jovan duhu milat hoti jo sandhi.

Ja son kabi sab kahat haiñ Bais-sandhi anubandhi.

37. The *nava sapta sobha* form one of the standard poetical common-places, and I am surprised that Mr. Beames is not familiar with the expression. His translation is quite unwarranted by the original, and the same remark applies to his version of the next three lines.

In these observations, I have taken for granted that Mr. Beames's text is substantially the same as mine, and I have little doubt that such is really the case. If, however, this supposition is incorrect, and I have thereby done him an injustice, I feel sure that the Society will allow him to vindicate the accuracy of his scholarship by printing the forty lines as they stand in his MS. I now proceed to offer a translation of my own, which however imperfect, will be found, I am confident, rather more faithful to the original.

*Translation.*

Towards the eastern quarter is a princely fort, Samud-sikhari, the impregnable; its king the heroic Bijai, of highly exalted descent: lord of thousand horses, elephants and lands, of imperial dignity; all puissant chiefs do him service 'mid the din of deep-sounding kettle-drums.

'Mid the din of deep-sounding kettle-drums, there is daily equipment of heroes, mounting ten thousand horses, their bodies gleaming with gold and jewels. There too innumerable elephants, myriads of horses, a warrior host with thousands of men, each bearing the royal umbrella, all of equal dignity. Ten were his sons, all gallant and fair, comely as the dawn, with countless stores of treasure; but comeliest of all, Prince Padam-sen.

The comely prince, Padam-sen, had a noble spouse; by her one daughter, brilliant as the sun, lovely as the new moon.

Lovely as the new moon, did I say? nay, lovely as the moon in its fulness; sweet as nectar was the grace of her blooming maidenhood. As the opening lotus, or the circling bee, or the wanton wagtail, so glittered her fawn-like eyes. The pearl, the parrot and the swan lost all courage in her presence, shimmering as a fish in a stream. The horse, the elephant, and the car lent her each its own special grace; this lotus of Prince Padam-sen must have been fashioned in female form by Kamadeva himself.

Fashioned by Kamadeva himself, a form of ideal beauty, stealing the hearts alike of gods, men, saints, cattle, birds and deer. Her body had all marks of good fortune; she was familiar with the sixty-four arts; and well-formed in all her members; she was graceful as the Spring. Laughing and playing with her companions in the garden of the palace, she beheld a parrot; great delight filled her soul.

Great delight filled her soul as when the swan sees the sun; as she bit her red lips, they seemed to the flock of parrots like a *bimb*. The bird flies round her; she startled, looks down to her breast; vehement desire takes her soul, she catches it in her hands. Gladly she detains the little Love, and goes with it into the palace; there in a cage studded with many jewels, she takes and places it.

There she takes and places it, forgetting all her sport, and with irrepressible delight begins teaching it to say Rám, Rám. The parrot, see-

ing her face every day, was very happy. ‘Surely this charming Padmini is the perfection of the Creator’s work; her wavy hair so trim, her lips and teeth red with betel juice, her form just budding into womanhood as the lotus, stately as the swan, with all the graces of Love himself, adorned by the sixteen arts of the toilette, and with strings of pearls; the eyes of all beholders are charmed, and they deem her a Venus embodied. May Siva and Uma, whom I worship, beholding my devotion, grant the union of Prithiráj (thus sings the Bard Chand) with this branch of the tree of Paradise.’

I hope scholars will do me the favour of comparing the above translation first with the Hindi text and then with Mr. Beames’s transformation of it. I conclude this article with a short extract from the Benares MS., being the third of my original series.

In my former papers I have described the opening of the poem and shewn how the Mahoba war was provoked by Parmál’s massacre of the fifty wounded Chauháns who had wandered off from the main body of Prithiráj’s army after an engagement with the Muhammadans. From that point I continue the narrative.

When the news reached Prithiráj at Dilli, his indignation was extreme. He at once summoned a Council of State, and finding all the chiefs unanimous for war, commenced immediate preparations for the campaign. An auspicious date was fixed by the priests, after performing a *s’ákal hom*, and the army had marched into encampments outside the city, when—

*Translation of the latter part of Canto IV.*

An envoy from king Mahil meets Prithiráj on the road before Dilli\* and tenders a letter, saying: “Alha and Udal, the king’s servants, are in the battle as the angel of death to the enemy; advance no further till you have slain Mallakhán and his puny force.”† This is the letter sent by the king to Prithiráj: “First put Mallakhán to death, then reconnoitre the city of Mahoba; having well reconnoitred, urge on your march thither by night and day. There is but a small force at Sarsa; you are a man of valour, ravage their land; gird on the sword for the fray, if there be any courage in you, O king of Sambhar. This is the advice I give, writing the letter with my own

\* ‘On the road before Dilli’—*Dilli sapathai*.

† ‘Puny force’—*Chhari-bhir Mallakhán ko*.

hand. Mallakhan's army is contemptible, utterly destroy it. Sarsa borders on Mahoba, there pass the frontier. The chief of his warriors have gone indignant to Kanauj: the Chandel has lost his senses, and stays still at Mahoba. There he stays careless, leaving all to me; I support his throne, and rule the entire land. Rouse your indignation, Chauhan, answer me as a king; take Parmál a prisoner, plunder the city of Mahoba."

Such was the letter given by the messenger to Prithiráj; the king, as he read it, was more delighted than words can tell. That instant he wrote in answer to the prince: "If the Chandel Rájá be conquered, half the kingdom shall fall to your share." Again and again he repeats the same words in writing to the Parihár.\* "If the land be conquered, I promise you dominion over one half of the whole realm."† Máhil's envoy Gopál spoke and said to the king: "Should Alha and Udal by any chance return from Kanauj all our arrangements‡ will come to nought. The king has grievously outraged§ them and banished them from the city; still, remembering their duty to their lord, when they hear of his distress, they will hasten to his side." Having uttered this caution, the messenger took the letter and departed. The Chauhan army started to ravage the country of the Chandels.

In the year 1140, on a Wednesday in the month of Kúár,|| the lord of Sambhar gathered his army and set forth to wreak vengeance on Parmál. When the assembled army broke up and marched from Dilli, earth trembled.¶ In the van were 500 elephants, huge as the

\* 'The Parihár'—that is, Máhil.

† The couplet stands thus: होई महि प्रस  
अर्धराज या कहतभा अफिय राज समस

Here *aphiya* is said to be a Márwári word signifying 'to give;' and one Pandit to whom I shewed the passage assured me that *tabhá* is also a Márwári word used in connection with *aphiya* to imply a solemn donation. Of this, however, I feel doubtful and prefer to take *tha kahat bhá* as three words, meaning 'I tell you.'

‡ 'All our arrangements'—सां के यां के रौल सब Here *raul* is apparently for *kaul*.

§ Grievous outrage—दीह दुष्य

|| The word in the text is *iklmás*: I am not certain what month is intended.

¶ The couplet stands thus—

जब दल जु रि डिल्ली तै वल्लिव दूटे वर द्यौनीधर हल्लिव, which may also be translated—When the assembled army marched from Dilli, forest trees were broken, the earth-supporter trembled.

ten guardians of the universe, and 100 exultant champions, each of whom could turn to flight 10,000 ordinary mortals. The king gave Kánh command of this advanced guard, and halted at Fort Gopáchal. Here Amarsi sent to his aid\* from Chitrakút 20,000 horse and 30 elephants. When Prithiráj fixed his camp at Gopáchal, all the people deserted their homes and fled to hide in the woods and mountain caves. Then Kaímás gave this wise counsel; "Mallakhán is a strong and haughty chief; get the better of him by a pilgrimage to Batesur. By the death of Mallakhán your fame will spread though the world." As Kaimás advised, so he acted. With clash and clang of soul-stirring music the army marched; earth quivered and shook; Seshnag's thousand hooded heads trembled at the weight. The Chauhán gave heed to the stratagem Kaimas had devised; no news of the halt at Gopáchal reached the Chandel. The army lingered† on the road to Batesur; the king of Sambhar struck off apart from the main body of the host. With him were 500 elephants, breaking down forts as huge as mountains, their riders equipped with splendid‡ spears. Under each chieftain were 500,000 men; as the Chauhán army marched, the earth-supporter's head shook. From Gopáchal Prithiráj made a cross-march to visit the shrine of Mahádeva.

When his camp broke up from Gopáchal, the crowd of elephants spread over the whole face of the earth. Under the tramp of his horses' hoofs, mountains were ground into powder as small as mustard seed. A moving canopy of dust warded off the rays of the sun. The Chauhán army with its gallant array of knights made forced marches, and with loud strains of martial music all arrived at Batesur. Summoning priests and bards to join his warrior train, the king in an ecstasy of devotion adored Sankara after bathing at Brahmanál. Attended by bards and sages to the Batesur temple, he touched the feet of the deity and reverently circumambulated the image. After bathing, he made an offering of 10 elephants, 100 horses and 2000 pieces of gold; all these gifts he bestowed upon the Bráhmans. Then

\* 'Aid'—कुमुप, for the Persian *kumak*.

† 'Lingered.' The word in the text is रिंग ई the precise meaning of which was doubtful, till a day or two ago when I heard it used by a rustic in Court to express the slow movement of a man whom the Police had apprehended and were dragging off to the lock-up.

‡ Splendid आसील, probably for Persian *asīl* or *asīl*. 'Spears'—भक्षार।

taking in his hand lotus and other flowers with fruits, roots, and incense, he presented them in the temple. Reclining on a couch of *kusa* grass, the king adored with clasped hands: "Grant me victory, Ahináth, then again will I visit thy shrine." The oracular lord of creation vouchsafed response and said: "The Chauhan army shall conquer, but perish in the conquest. Many wounded men shall fall in the battle, bereft of life; you shall be protected by the grace of Brahma and Gorakhnáth." The king bowed his head on hearing this, and great joy filled his soul: "Come life, come death, be victory mine, then heaven is won."

The Chauhán left the temple of the eternal Siva rejoicing; the army panted for the fray, the trumpets gave a dread sound. As they marched from Batesur, the elephants led the van; all the Chauhán forces met at the Charmavati. The trumpets gave a fierce sound; great was the gathering of kings and nobles: Seshnág was troubled by the crowd of hosres and elephants, as the army passed on to Indragarh. The Chauhán princes met at the river Sindh; at dawn Mallakhán heard the news from the chief of the spies: "The Chauhás have arrived at Basavgarh."\* On hearing this, Mallakhán acted prudently and summoned his counsellors, and priests, saying: "Speak, friends, and advise me; shall I keep my family with me, or send them to Mahoba? join counsel and declare what seems to you best." His kinsmen and counsellors made answer, revealing their thoughts: "Despatch your family to Mahoba." Thus spoke all the counsellors and bards: "Set your mind at ease by sending the women to Mahoba; then give your whole soul to the battle."† Mallakhán pondered the advice of his kinsmen and counsellors, and went into the seraglio to speak with the Queen.

*So ends the fourth canto, entitled Mallakhan's Council.*

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*Postscript.*

While correcting the proof sheets of the above, I received a copy of the Journal containing Mr. Beames's complete translation. I have

\* Bāsavgarh—i. e. Indragarh: Vāsava being a name of Indra.

† The following Persian words occur in the above passage: viz., *sardár*, *qáçid*, *ráh*, *kumak*, *faúj*, *khabr*, *asíl*, *pál*, and *mahall*.

read this with great interest, and congratulate the writer on his spirited reproduction of the general substance and style of the original. I only demur to its being described as a literal translation, which it really is not. However, a little looseness of rendering will make the work not a whit the less acceptable to the general reader; and any asperity of verbal criticism, into which I may have been betrayed, will, I trust, be attributed solely to the fact that I expected a work of rather severe type from a scholar who has achieved a philological reputation. Yet I must express a hope that, if Mr. Beames continues in his idea not only of translating but also of editing the poem, he will reproduce the MSS. as closely as possible, and not venture upon hasty emendations, which in the majority of cases, more mature reflection would convince him were quite unnecessary. Thus in the forty lines which we have both translated, I see no occasion to alter more than a single letter, reading in one place *biddh* for *giddh*. Mr. Beames on the other hand with a better MS. before him, proposes several sweeping alterations, which his brief notes enable me to see are based on mere misconceptions of the content. F. S. G.

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*Reply to Mr. Growse.*

I wish to be brief, because Mr. Growse has already occupied too much space to no purpose, and because my remarks are few and simple.

1. My text differs so widely from Mr. Growse's, that on reading his, it looks to me like quite a different poem.

2. There are only four MSS. of Chand accessible to European scholars. Two of these are in my possession, the third is in the library of the Royal Asiatic Society in London, the fourth in the Bodleian at Oxford. Mr. Growse possesses *no* copy of the poem.

3. Having no copy of Chand, but having picked up some old Hindī works which contain copious but garbled extracts from Chand mixed up with extraneous matter, Mr. Growse condemns my translation in no measured terms, because it differs from his own incorrect text!

I will first defend my own translation in those places where Mr. Growse attacks it, and then give the correct version of the original from the real MSS.

I do not criticise Mr. Growse's specimens of translation, as the Hindi from which he translates is not traceable in either of my copies of Chand, and appears not to be written by Chand at all, but by some modern author who has borrowed the poet's name.

Lines 1-4. These lines stand as follows :

पूरव दिस गढ गढन पति ।  
समुद सिखर अति द्रुग ।  
तहां सुविजय सुर राज पति ।  
जादव कुल महाभुग ।

This shews how erroneous Mr. Growse's version is. It foists in a second दिसि in the first line, then writes *durg* for *drugg*, not knowing that Chand always throws the *r* back in such words as these, as *sarb* for *sarb*, *dhram* for *dharm*, *subran* for *subarn* and many others, and then to eke out the rhyme alters *bhug* into *bhurg* a purely imaginary word: *bhug* is a common Chand corruption for *bhuj* 'arm,' and the compound *mahābhug* means, as I have translated it 'mighty armed' like 'maha bahu' a common epithet of kings. Mr. Growse's notes on these four lines are simple nonsense; and his mistake of supposing *suviyaya* 'very victorious' to be the name of the king is the more ridiculous because the real name Padam Sen is given a few lines further on.

4. *Sevahi*, says Mr. Growse is a verb! If so, it would be interesting to know what part of the verb it is. Mr. Growse is, it would seem, unaware of the Prakrit form of the dative plural (Lassen Inst. B. p. 311, where it is wrongly given as an instrumental) from the Sanskrit from सेवेभ्यः, which in Prakrit becomes सेवेहिं and finally सेवहिं.

As to *nisán* meaning 'a kettledrum,' it may be so, but I do not find it in five of the best dictionaries; and as the real texts read *bahusād*h or *sādd* and not *nād*, I prefer to retain the ordinary translation of 'standards.'

5. Here again Mr. Growse's text is absurdly wrong; a reference to my text as given below will shew that my rendering is correct. The "puissant chiefs" of Mr. Growse's translation, are evidently a creation of his own brain, or of his Pandit's, for I do not see how he gets it out of his own text even.

7. "Mr. B. has entirely omitted the words *hay sankhi*." Yes, I have, because they are not in the text.

8. "Apparently Mr. B. has wrongly divided the words." Mr. B.

has done no such thing, but has translated his own text literally ; not having had Mr. Growse's fancy text to confuse him, for which he is thankful. The introduction of the words 'Siva's bow' was caused by the simple fact that '*pinḍka*' which is the name of that bow, occurs in my true text, though not in Mr. Growse's jumble.

9. "The text speaks of ten sons only, no daughters." The text says '*das putr putri.*' If this does not mean 'ten sons and daughters,' I wish to know what it *does* mean? As to the suggestion that Padam Sen was one of these ten sons, it is an unfounded assertion into which Mr. G. has been betrayed by his faulty text.

12. *Tá ur putri pragaṭ* says my text. I translate word for word. 'From her breast a daughter sprung.' Mr. Growse says, "this is awkward English and not required by the original." The preceding line is *ta ghari nári suján*, which again I have rendered literally, 'In his house was a wellborn dame.'

14. Here again Mr. Growse is blundering over a bad text. The word he reads *sisu* is really *sasi* the moon ; and the word he reads *vais* and tell us is for *avasthá*, (though where he got this idea from is a puzzle), is simply *bhes*, 'dress, appearance, guise' as I have given it ; '*samir*' is an error for '*samip*;' and Mr. Growse's text is quite wrong in the fourth line, which he ignorantly (or rather his Pandit again) mixes up with the third, for it wants at least a couple of feet to make it scan !

15, 16. Your text as it stands is not intelligible, and I should like to know by what process you get your English out of it. And *á propos* of your English, what do you mean by pearls, parrots and swans shimmering like fish in a stream? I see nothing about "shimmering" or 'streams' in your text. I am afraid your Pundit, in whom you trusted, has deceived you ; or was it the intelligent bunnias of that village on the frontier of your district, mentioned in your former article?

22. My rendering cannot be correct since the Hindus reckon only six sciences, says Mr. Growse. To this I reply, that Chand says *chaturdas* ; and Mr. Growse is perhaps thinking of the six schools of Vedic science, to the exclusion of the secular sciences.

23, 24. These lines are remarkable, it appears, as the only two which I have translated accurately ! I might have been spared this sarcasm ; if Mr. Growse's object had been honest criticism, nothing

need have been said of these lines. My offence in the eyes of this gentleman, who is a stranger to me and to most scholars in Europe, consists in my having dared to meddle with Chand at all, seeing that he had constituted himself interpreter in chief, and head referee on all questions connected with this author.

The rest of Mr. Growse's criticisms are founded on a text so widely differing from mine, that I cannot even find which of my lines he refers to.

In conclusion, I can only say that I will take no further notice of anything Mr. Growse may write. I cannot undertake to teach him the rudiments of old Hindi in the Society's Journal, nor can I spare the time to copy out for him my text. I am preparing an edition of the complete text for the Society much of which is ready, and will appear shortly. Mr. Growse will then know what is really in Chand and what is not. Till then I should recommend him to hold his peace, or at any rate not to accuse of want of scholarship, a man whom he does not know, on the strength of a text which he has not seen. And I would give him a further parting word of advice, namely, not to rely on his Pandit too entirely, but to try and reason out for himself the true meaning of every word, and above all, not to listen too credulously to village shopkeepers and grainsellers, however interesting and intelligent they may be !

My text, as it stands in two complete MSS.

अथ पदमावतीसम्यो लिख्यते.

दुहा ।      पूरव दिस गढ गढन पति ।  
 समुद् सिखर अति दुग्ग ।  
 तहां सुविज्जय सुर राजपति ।  
 जादव कुल मच्चा भुग्ग ॥ १ ॥  
 हसम हय गय देस अति ।  
 पतिसाय रे मर्जाद ।  
 प्रबल भूप सेवहिं सकल ।  
 धुनि निशान बज्र साद ॥ २ ॥  
 कवित्त      घन निशान बज्र साद ।  
 नाद सुर पंच बजत दिन ।  
 दश हजार हय चढत ।  
 हम नग जटित साज तिन ।

गज असंघ गजपतीय  
 सुहर सेना तीयस लषऊ  
 इक नायक कर धरि पिनाक ।  
 धर भर रज रषऊ  
 दस पुत्र पुत्रीय कह समस्य  
 रथ सुरंग उमड उमड ।  
 भंडार लखोय अगनित पदम ।  
 सो पदम सेन कुंवर सुघर ॥ ६ ॥  
 दुहा । पदम सेन कुंवर सुघर ।  
 ता धरि नारी सुजान ।  
 ता उर पुत्रो प्रगट ।  
 मनऊं कला ससि भान ॥ ४ ॥  
 कवित्त मनऊं कला ससि भान  
 कला सोलह सो वनीय ।  
 बाल भेष ससि ता समोप ।  
 अमृत रस पिनीय ।  
 विगसि कमल अमृत समर ।  
 नैन पंजन द्विग लुटोय ।  
 हीर कीर अरु बिब ।  
 मोती नथ सिष अहि घुटोय ॥ ५ ॥  
 कत्रपति गथं केहरि हंस गति ।  
 विहव माय संचै सचोय ।  
 पदमिनीय रूप पदमादती ।  
 मनहु काम कामिनिरचोय ।  
 मनहु काम कामिनिरचोय  
 रचोय रूप की रास ।  
 पख पंखी मृग रूप मोहिनी ।  
 सर नर मुनिय रपास ॥ ६ ॥  
 सामुद्रिक लखन सकल ।  
 चौसठि कला सुजान ।  
 जानि चतुरदस अंग षट  
 रिति बसंत परमान ॥ ७ ॥  
 सधियन संगे खेलत फिरत ।  
 महल निवाग निवास ।  
 कीर इक दिष्पीय नयन ।

तव मन भयौ हुलास ॥ ८ ॥  
 मन अति भयौ हुलास ।  
 बिगसि जनु कोक किरन रवि ।  
 अरुन अधर तीयस धर  
 बिंव फल जानि कीर बवि ।  
 यह चाहत चष चक्रित ।  
 वह जुत कीय भरपि भर ।  
 चुंच कुटोय लोभ अति ।  
 लोथौ तव गहित अप्प कर ।  
 हर्षत आनंद मन महि हुलास ।  
 लैजु सहल भीतरि गई ॥  
 पंजर अनूप नग मनि जटित ।  
 सो तिहि महि रषत भई ।  
 दुहा तिहिं महि लै रषत भईय ।  
 गई पेल सब भूल ।  
 चित कुट्यौ कीर सो  
 राम पढावत फूल ॥ १० ॥\*  
 कीर कुवरि तन निरखि दिखि ।  
 नष सिष लौं यह रूप ।  
 करता करीय बनाय कै ।  
 यह पदमिनी सरूप ॥ ११ ॥  
 कवित्त । कुटिल केस सुदेस  
 पाह परचियत पिक मद् ।  
 कमल गंध वयसंध ।  
 हंस गति चलत मंद मंद ।  
 सेत वस्त्र सोहै सरीर ।  
 नष खाति बुंद जैसा ।  
 भसर भसहि भुल्लहि सुभाव ।  
 मकरंद वास रस ॥

Is not this enough? If not, Mr. Growse must wait till my complete edition of the text comes out.

JOHN BEAMES.

\* The preferable reading is राम राम पढती फूल ॥ she could not have been teaching the parrot as she is said in the preceding line to have forgotten all about him. I have altered my first rendering of this line, as I got the Agra MS., after I had written it.

*Some Observations on the Temples of "Razdan" or "Razdoing" in the "Lár" Pergunnah, Cashmere. By Lieut.-Col. D. F. NEWALL, R. A.*

*(With 3 Plates.)*

I now proceed to afford as much information as I possess of the group of temples called 'Razdán' or 'Razdoing' by the inhabitants of the Lár valley in Cashmere.

These extensive ruins, certainly the next to those of Martund in importance—if not even more extensive in the superficial space occupied by them,—are the only group not described by Cunningham in his learned and masterly essay on the Arian order of Architecture, printed in the Journal of the Asiatic Society of Bengal for September, 1848. Before proceeding to put on paper my own speculations regarding them, I will transcribe *verbatim* the memorandum I find in my journal on the occasion of my visiting and measuring these ruins on the 24th, 25th, 26th September, 1852. I must premise, however, by stating that they are overgrown with dense underwood and large forest trees, and it was only after much labour and the employment of many hands in cutting away the jungle that I was able to collect the following data. I transcribe from my journal therefore, "Description of the *Razdán* or *Razdoing* ruins under the *Boodshere* Hill in the *Lár* pergunnah of Cashmere."

(1.) They consist of two principal temples connected by the remains of a paved causeway and several connecting buildings, cloisters, &c.

(2.) The Northern temple, of which the roof has fallen in, is  $31\frac{1}{2}$  feet square and has been surrounded by cloisters  $160' \times 120'$  in measurement. The interior chamber is  $14\frac{1}{2}'$  square. In its front is a stone reservoir  $11' \times 6\frac{1}{2}'$  feet of a very peculiar construction, and the use of which is not quite obvious, unless it has served as one of those vats from which charitable brahmins were wont to distribute rice, &c., to the poor." (*Vide Plate III.*)

There are several small buildings grouped around it. The one sketched was probably at the entrance and is about 20 feet wide. At the north-west angle of this temple is the *Nara Nag*, a small lake or

pool, and a place of *Snán* or religious ablution in the pilgrimage of Hurmooktur-gunga. Into this pool, the pilgrims of the present day use to cast their mountain sticks and *phoolas* (grass shoes) on their descent from the mountains whilst on their return from the holy lake of Gungadul.

(3.) About 80 yards in front due south of this temple are the remains of a large building formerly supported on pillars, parts of which still exist in the corners, and that on the pathway, which I at first mistook for a sort of "font," is peculiarly an object of veneration to the pilgrims who there make their final salaam. This\* building whose exact use I find it difficult to conjecture, measures  $110' \times 60'$ . The entrance to it has been by a massive flight of steps on the south side.

(4.) Immediately in front of the above upon the causeway are the ruins of another small building about  $25'$  square.

(5.) The Southern temple—by far the most perfect of the group from having its roof entire—I made by measurement  $31\frac{1}{2}' \times 30\frac{1}{2}'$ . It may perhaps have been  $31\frac{1}{2}$  feet square like the other. The interior chamber,  $14'$  square, with dome entire about  $20'$  high interiorly, was surrounded by an enclosure  $120' \times 80'$ . It is situated on higher ground above the Northern temple; and, owing to the precipitous nature of the ground, the dimensions of the North and East faces of the cloisters have been curtailed. A gateway at the North-West angle of this enclosure leads out into the causeway.

There are no less than six groups of buildings immediately around this temple, in the roof of which several large fir trees have taken root, presenting a singular appearance, their knarled twisted roots grasping the loose stonework, and their height being about equal to

\* On consideration I am inclined to think that this large building may have been a "masjid" or perhaps a summer house constructed at the same time as the terraced garden called the *Guláb Bāgh* immediately adjacent to it, in comparatively recent times by some Muhammadan magnate, possibly (owing to the occurrence of the name *Boodsher* or *Boodsháh* as applied to the place by the inhabitants) by "*Zawn-ul-'ábidín*" to whom that title was emphatically applied. This same king also built the "Lank" or island in the Wulu Lake about the year 1443, A. D., with its mosque and summer house on the site of an ancient temple, whose summit was at that time visible about the waters of the lake. Vide page 8 of my sketch of Muhammadan History of Cashmere, published in the Asiatic Society's Journal, September, 1854. It was a common practice of the Muhammadans thus to turn to account existing Hindu buildings and sites.

that of the temple, which may be 50 or 60 feet. The sketch partially represents this. (*Vide Plates II. and IV.*)

(6.) The entrance of both temples, and that of the large centre building are due south. The entrance of the enclosures due west. The two temples are about 230 yards apart, have been connected by a stone causeway and a connecting chain of buildings.—Opposite to the entrance to the gateway of the southern temple is a raised plateau of land built up into what has evidently been a garden (now called the *Guláb Bigh*).

Thus far my notes conduct me, and I shall now, before closing this paper, venture to put before the Society some remarks and ideas which subsequent reading has enabled me to form on this interesting group of temples. I would remark, however, that although so extensive, they do not approach some of the other temples of Cashmere in interest of architectural detail. The two centre temples, however, are Ariostyle, and those to which they bear most affinity are those of Puttun, and I would attribute them to about the same era. I see that Cunningham assigns about the date 883—901 A. D. to the Puttun-temples which were built by Sankara Vermá. With regard, however, to some of the adjacent buildings and fragments I have spoken of as surrounding the two groups at Razdoing, I am inclined to attribute to them a very high antiquity of origin; and I even think it probable that there may have been more ancient temples than the present ones standing on the same site; and that these I have described may have been repaired or reconstructed (as was usual) in their present form. I am led to this conclusion by what I find recorded in the *Raja Tarangini* (Persian translation) that in the reign of Jaloka, son of Asoka (to whose reign I see the date 250 B. C. assigned), it is related that this prince (Jaloka) was wont daily by means of a *serpent*\* to visit daily the temples of Waramool, Bej Biharie, and Lar, and

\* This "*serpent*" is frequently mentioned in the ancient chronicles of Cashmere, and appears to have been a mechanical machine, a propeller, or flying bridge. It is related that King *Meegwahun* having conquered Ceylon, Surat, &c., returned to Cashmere by way of Scinde, and passed his army over the river Indus (A. D. 22) by means of *serpent*; but the fabulous and the quasi-Historic are so blended in the earlier chronicles, that it is impossible to dis sever them, and although the word is the same, the chronicle in the case quoted in the text, of Jaloka's daily visit to the three shrines seems to imply an aeronautic element as the sloke speaks of a "flying" serpent; but Jaloka is always mentioned as a magician king possessed of supernatural powers.

I conceive that by this last we may fairly infer that the temples under consideration are alluded to, as there is no other group one-tenth so extensive to be found in the Lar or Scinde valley.

Should this conjecture be correct, they would undoubtedly possess a very high antiquity and in fact must be regarded as *the* most ancient temples in the valley of Cashmere (not excepting that on the Takht-i-Sulaimán or Sandhimána parvat) which is stated to have been built by this very king Jaloka, but seems to have been repaired and restored to its present form by Gopaditya about A. D. 250, and is generally considered the most ancient temple extant in Cashmere. I may remark that a few fragments of temples overwhelmed in the dense jungles exist to this day near Baramoola, but they have never been to my knowledge deemed of sufficient importance to merit disentanglement or description. Nevertheless I believe these, together with the group I have taken the liberty of introducing in this paper, to be the very oldest remnants of the ancient architecture of Cashmere; for as I have stated in a former paper, the temples of Bejbiharie mentioned with those of Lar and Baramoola as already existing in the time of Jaloka, were overthrown by the Muhammadan fanatic Shihábuddín about the end of the 14th century, and are out of contest for the honor, such as it is, of having survived the storms of two thousand years, the attacks of Muhammadan fury, and the overwhelming vegetation of the dense forest.

The dates of other and possibly more attractive temples, such as Martund, Pyatch, Pangethur, Puttun, &c., are much more recent, as is also that on the Takht-i-Sulaimán in its present form as stated above.

I have, I hope, said enough to attract attention to this remarkable group of temples hitherto so strangely overlooked. Situated as they are, however, in so remote a spot, and overwhelmed as they are in forest, it were no light task to undertake their entire disentanglement. I believe I have nearly exhausted this subject, or rather my slender information on it, but before finally quitting it, I would respectfully suggest to the Society that further investigation into the primitive form of worship of the Cashmere valleys and mountains seems desirable, as I have reason to think that relics\* of a religion earlier

\* Bhadiakal, in the Kamraj, is a sort of small Stonehenge; and elsewhere in the deep forests appear isolated monoliths, altars, &c., attesting a certain form of sylvan or Druidical worship.

than the Brahminical faith are to be met with in the deep forests of Cashmere, and which I believe to be perhaps anterior to the great Aryan invasion, when Cashmere in common with the other provinces of Hindústán, was colonized by the Hindú race.

Professional occupations have long interfered in my case with the pursuit of such investigations in which I once felt much interest; and I must crave the indulgence of the Society for any crude or ill-studied points I may have noted for their consideration. I have availed myself of the first leisure I have obtained for years for such writing; and even now, having no books of reference with me, I possess nothing but my private MSS. journal, and notes to refer to for dates, &c. beyond my memory, and this I find, after so long an interval, sometimes fails me. I find myself therefore abruptly forced to bring this paper to a close.



*Translations from the Tārīkh i Firūz Shāhī, by the late MAJOR*

*A. R. FULLER, Director of Public Instruction, Panjáb.*

*(Communicated by T. W. H. TOLBORT, Esq., C. S.)*

*The Reign of 'Aláuddín i Khiljī.*

In the name of God the most merciful!

Praise\* be to God, the cherisher of mankind, and blessings rest upon his prophet, Muhammad, and all his offspring, as well as perfect peace and safety.

Thus says the most devout of Musalmáns, Ziá of Baran, when, during the year 695, Sultán 'Aláuddín ascended the imperial throne, he conferred on his brother the title of Ulugh Khán, on Malik Nuçrat Jalesarí that of Nuçrat Khán, on Malik Hizabruddín that of Zufar Khán, and on Sanjar, his [Mír Majlis] that of Alap Khán. He also raised his intimate friends to the rank of Amírs, and such as were already Amírs. he promoted to the grade of Maliks. He further granted every one of his old associates permission to take fresh horsemen into service, and as a countless hoard of wealth had fallen into

\* *Ed. Bibl. Indica*, by Sayyid Ahmad Khán, p. 243. Vide also *Baddoni*, I, p. 182. Words in [ ], and the foot notes, are additions or slight alterations made by the Editor of this Journal.

his hands, and he had been guilty of an act condemned alike by God and man, either with a view to the expediency of the moment, or to deceive the public, or else for the purpose of glossing over the murder of Sultán Jaláluddín, he threw open the door of liberality and munificence before (high and low, *i. e.*) all grades. He occupied himself too in making preparations for his journey (to the capital of Delhi), but owing to the incessant fall of rain, the copious floods, and the heaviness of the sands, he continued to delay his departure and was purposing to proceed to Delhi after the rising of Canopus. He was under considerable apprehension, however, of Arkalí Khán, the second son of Sultán Jaláluddín, who was one of the Rustams of the age, and the most valiant man of his day. As soon therefore, as the news arrived from Delhi, that the latter had not come yet, Sultán 'Aláuddín conceiving his non-arrival to be favourable to his own fortunes, and knowing that the throne of Delhi could not be upheld by Sultán Ruknuddín Ibráhím, and that there was not sufficient coin in the Jaláli treasury to raise and enrol fresh levies, he took advantage of the opportunity, and in the very height of the rainy season, set out for Dehli. From the excess of rain that year, the Ganges and Jamna had become vast rivers, and every (paltry) stream was as a Ganges or a Jamna, and from the depth of mud and mire, the roads remained (almost impassable). At a season like this, Sultán 'Aláuddín set forth from Karah with his elephants and his wealth and his army; and he exhorted his Kháns and Maliks to use their best endeavours towards raising fresh horsemen, (bidding them) not to be particular or scrupulous in fixing the amount of their pay, nor to take into account the exact year and month (of enlistment,) but to scatter about gold without stint, so that vast hosts might be collected by such bountiful largess. About the time Sultán 'Aláuddín was proceeding towards Dehli, they had constructed some small light moveable machines [*manjaníq*], and at every halting-place where his pavilion was erected, just at the time of his alighting there, they daily placed in front of his portico five maunds of gold coin in one of these waggons, and scattered them among the spectators; whereupon the soldiery and the neighbouring population used to congregate all round, and carry off the coin. The concourse in front of the royal portico thus increased day by day, and by the end of two or three

weeks the news spread, throughout the whole of the districts [*khittat*] and towns of Hindústán, that Sultán 'Aláuddín was on his way to take possession of Delhi, and was scattering gold profusely among the populace, and was entertaining countless levies of horse and foot. On this, the population, whether military or non-military, all hurried towards the Sultán's camp; so that by the time 'Aláuddín reached Badáon, fifty or sixty thousand horse and foot had congregated in this royal camp during a rainy season like this, and had formed a vast multitude. When Sultán 'Aláuddín arrived at Baran, [in the open space of the Masjid of the town] Nuḡrat Khán began taking the inhabitants of the place into service whether they were nobles, men of note, or common soldiers, and paid no heed to fixing the amount of their wages, or taking security from them. In a loud tone he proclaimed: "If Delhi fall into my hands, I shall be able to acquire on the first year a hundred times as much wealth as what I now disburse; and should the kingdom not come into my possession, it is better that the wealth which I have brought away from Deogír with such infinite trouble, should fall into the hands of the people rather than into those of my foes and adversaries.

On Sultán 'Aláuddín's arrival at Baran, as he had made over a force to Zafar Khán, he directed him to proceed by way of Kol, and march along that road at a rate corresponding to that at which he himself (the Sultán) marched along the Badáon and Baran roads. The Maliks and Amírs of Jaláluddín's party who had been nominated to oppose the advance of Sultán 'Aláuddín and Zafar Khán, such as Malik Tájuddín Kúchí, Malik Abáji Ákhurbak, Malik Amír 'Alí Díwánah, Malik 'Usmán Amír Ákhur, Malik Amíri Kalán, Malik 'Umar Sarkhah, and Malik Hiran-már, all came into Baran, and joined the Sultán. They each received 20 or 30, and some even 50 maunds of gold; and to every one of the force which accompanied those Maliks and Amírs, a present of 300 tankahs was distributed. The Jaláli army being thus totally broken up, the Amírs that had stayed behind at Delhi began to waver in their allegiance and the maliks who had gone over to Sultán 'Aláuddín used to say publicly, "The inhabitants of the city certainly find fault with us, and declare that we have been guilty of base ingratitude in turning our backs on our master's son and going over to the

enemy, but these misguided individuals do not perceive that in reality the kingdom of Jalāluddīn came to an end the day he set out from the palace of Kilokharī,\* and of his own free will went in hot haste to Karah, and there of his own accord and with his eyes open, put his neck and those of his intimate associates in jeopardy. What can we do therefore but join Sultān 'Alāuddīn?"

At this juncture when the Maliks had all gone over to Sultān 'Alāuddīn, and the Jalālī army was completely broken up, Malikah Jahān, who was one of the most weak-minded of weak minded women, sent to call Arkalī Khān from Multān, writing to this effect: "I was wrong in placing your younger brother on the throne, while you are still in existence; for none of the Maliks and Amīrs stand in any awe of him, and most of them have gone over to Sultān 'Alāuddīn, so that the sovereignty is passing out of our hands. Make post haste therefore, if you can, and come to me, and mount the throne of your father, and redress my wrong. As for the son who now occupies the throne, you are his elder brother, and more worthy and better fitted for the sovereignty; he shall therefore serve you as an obedient vassal. As for me, I am a woman, and females are (proverbially) deficient in intellect; (I confess) I have been in error, but pardon the fault of your mother, and take possession of your father's kingdom. Should you give way to your resentment and fail to come, Sultān 'Alāuddīn is advancing in such strength and grandeur that he will assuredly seize upon Delhi, and will spare neither me nor you."

Arkalī Khān would not come at his mother's bidding, however, but sent her an excuse (saying): As the nobles and their retainers have all gone over to the enemy, what would be the good of my coming? Sultān 'Alāuddīn no sooner heard that Arkalī Khān would not comply with his mother's invitation than he ordered the drum of rejoicing to be sounded.

Some delay occurred to Sultān 'Alāuddīn in the vicinity of the fords of the Jamnah, owing to the vast volume of water in that river, and his having no boat in his possession; but while he tarried at

\* Kilok'harī lies about eight miles south of Dihlī, on the Jamnah. "Six months after his accession, Sultān Mu'izzuddin Kai Qubād left Dihlī, and founded Fort Kilok'harī, the ruins of which may even now [A. H. 1004] be seen on the [right] bank of the Jamnah near Khwājah Khizr's ford." *Baldoni* I., p. 137, where the spelling *کیلرگھڑی* is to be corrected to *کیلوکھڑی*.

various places along its bank, [Canopus rose above the horizon,] the stream decreased, and he was thus enabled to cross with the whole of his forces at the ford of Bághpat, after which he encamped in the plain of Júd.\*

Sultán Ruknuddín Ibráhím then issued forth from the city with the royal insignia, attended by such force as he still had with him, and pitched his camp opposite to Sultán 'Aláuddín's, with the intention of bringing on an early engagement. After night had come on, however, the entire left wing of Sultán Ruknuddín's army having mounted their horses about midnight, a tremendous uproar arose, and they all went bodily over to Sultán 'Aláuddín. Sultán Ruknuddín was thus rendered utterly powerless, but towards the close of the night they managed to open the Badáon gate; and he having taken some gold tankahs out of the treasury, and a few horses out of the stable, placed his mother and other females of his household in front, and issuing forth under cover of the darkness from the Ghaznín gate, took the road to Multán. Malik Quṭbuddín 'Alawí together with his children and Malik Ahmad Chap also abandoned their homes, and accompanied Malikah Jahán and Sultán Ruknuddín towards Multán.

Next day Sultán 'Aláuddín set out with regal pomp and splendour, and entered the plain of Sirí (سیری,) where he alighted, and the sovereignty was there delivered over to him. He also pitched his camp at Sirí, and the dīwáns, the custodians of the elephants with the animals in their charge, the governors (*kotwáls*) with the keys of their forts, the justices and judges, and all the other persons of note and respectability in the city waited upon him; whereupon the earth assumed a totally different aspect, and a state of affairs altogether new arose throughout the world. By the immensity of his wealth, and the vast number of his adherents, no matter whether an individual (here and there) took the oath of allegiance to him or not, the public prayers were offered in his behalf, and the coinage of the mint was struck in his name.

\* Bághpat (باغپت) lies north of Dihlí on the Jamnah. Opposite to it on the right side, our maps give a place Joondhpúr, which appears to be the Júdḥ (جودد), or with a nasal *n*, جودن mentioned by Baraní. For Bághpat, the Society's Edition, p. 246, l. 2 has كاتھ Kát'h (?). Regarding Sirí, *vide* Journal A. S. Bengal for 1847, p. 974; but in the whole article Sirí is wrongly spelt *Secree*, for *Seeree*; also J. A. S. B. 1866, p. 199.

Towards the end\* of the year 695, Sultān 'Alāuddīn entered into the city with a most wonderful retinue and a countless multitude, and took his seat on the throne of Delhi in the Daulat Khānah, after which he repaired to the Koshak i la'l, (*i. e.*, crimson palace) and made that the royal residence. As there was a countless hoard of wealth accumulated in his treasury, and vast sums had been distributed in largess among the people, whereby their purses and money bags had been replenished with coin [*tankahs* and *jetals*,] they gave themselves up to gaiety and pleasure, and indulged in wine and all kinds of revelry. Within the city they erected several wondrous pavilions, where wine, sherbet, and betel were distributed gratis; and in almost every house an entertainment was held. The Maliks, Amīrs, and all the other men of note and respectability invited one another to feasts; and wine and beauty, music and mirth, became the order of the day.

Sultān 'Alāuddīn also, under the excitement of youth and prosperity, and the pride of his countless treasures, his servants and domestics, and his numerous elephants and horses, was immersed in festivity and pleasure, and from the extent of his generosity and munificence, he made the populace ardent supporters of his rule and government. From motives of state expediency moreover, he bestowed offices and estates [*aqṭā'*] upon the Jalālī Maliks and Amīrs who had gone over to his side. To Khwājah Khaṭīr who was one of the most celebrated Wazīrs, he gave the dignity of prime minister; to Qázī Ḥadr i jahān Ḥadruddīn 'Arīf, the father of Dāwar Malik, the Kazā i Mamālik; and [the offices of] Sayyid Ajall, Shaikh Islām, and Khaṭīb he left to the former Sayyid Ajall, Shaikh Islām and Khaṭīb, respectively. The Dīwān i inshā too he conferred on the former 'Umdatalmulk, father of Malik Hamīduddīn† and A'azzuddīn, and he sent for Malik Hamīduddīn and Malik A'azzuddīn, the sons of 'Umdatalmulk, who in wisdom, virtue, and a thorough knowledge of mankind, as well as in their high and noble birth, and all kinds of excellencies, possessed no equals; one of whom became a confidential officer of the royal household, and the other was entrusted with the management of the Dīwān i inshā.

\* The 22nd Zī Hajjah 695, or 20th October 1296.

† The *Bibl. Indica*, Edition, p. 248, has *Amīruddīn* (?), and immediately after *Hamīduddīn*. For *Dīwān i Inshā* we find under the Mughuls the title of *Mīr Munshī*.

Although Nuçrat Khán was Náib i mulk, during the first year he was made Kotwál, while Malik Fakhruddín Kúchí obtained the post of Dádbeg i hazrat,\* Zafar Khán became the 'Arzimamálík,† Malik 'Abáji Jalálí [*i. e.*, who had served under Jaláluddín] the Akhurbeg, and Malik Hiranmár, the Náib Bárbeg. Such an assemblage of Kháns and Maliks both of the Jalálí and 'Aláí party was thus congregated at the Sultán's Court, as could never have been witnessed in former times.

Malik 'Aláulmulk, the compiler's uncle, was appointed to Karah and Audh during the first year of his reign, and Malik Júná received his old post of Náib Vakíldar, while Muayyidulmulk the compiler's father, was given the place of Náib and Khwájahship of Baran. Thus were all the onerous duties and important situations committed to the charge of able, eminent, and experienced persons, and Dehli as well as all other parts of the country became a rose garden and a pasture.

Estates were then bestowed on each Malik,‡ grants made to religious communities, and lands, pensions, and gratuities lavished on all such as had just claims to them ; while a considerable increase was added to those already in existence.

[To the people he gave new employments.] The people consequently grew so enamoured of gold, that the mention of Sultán 'Aláuddín's base deed, and his ungrateful treachery never crossed any one's lips, and naught was left to mankind but to revel in gaiety.

In the first year of this reign moreover, the retainers of 'Aláuddín, both new and old, had reached a vast number, yet all of them received donations of [twelve and] six months' salary in hard cash ; and during that year folks of all classes both high and low lived in such ease and affluence, that I never recollect seeing in any age or period such perfect happiness and contentment, nor can those who are of much riper years than I recal such to remembrance.

\* *I. e.*, the Dádbeg of the residence of the emperor, as opposed to the office of *qází i lashkar*. The office corresponds to that of the Mír 'Adl under the Mughuls. For *Kúchí* the list of grandees (Ed. Bibl. Indica, p. 240) has the more usual *Júná*.

† The '*Arz i Mamálík* corresponds to the *Mír 'Arz* of the Mughuls, whose office is defined in the *Aín Akbarí*, p. 257.

‡ Perhaps it would be correcter to say—*Mílks* and *Waqfs* were bestowed on such as were worthy of *waqfs*. The word *amlák* is the pl. of *milk*, not of *malik*. Vide *Aín i Akbarí*, p. 271. Soon after 'Aláuddín resumed the *mílks* and *waqfs*, as Akbar did with the *Sayúgháls* of his times.

At the very outset, directly Sultán 'Aláuddín had settled himself on the throne of Dehli, he first of all set about the Multán business, and applied himself to the overthrow of Sultán Jaláluddín's sons. He forthwith nominated Ulugh Khán and Zafar Khán with a party of Maliks and Amírs and [30 or] 40,000 horse to Multán, whither they proceeded, and at once invested the fortress. After the siege had continued for a month or two, the Kotwál and inhabitants of Multán turned away from their allegiance to Sultán Jaláluddín's sons, and some of the nobles came out from the fort to Ulugh Khán and Zafar Khán.

The Sultán's sons then made use of Shaikhul Islám Ruknuddín as their envoy, and through him asked quarter of Ulugh Khán, and after entering into a compact and treaty, they took the Shaikh along with them and accompanied by the Maliks and Amírs who still adhered to them, repaired to the presence of Ulugh Khán. He treated them with great respect on that occasion, and gave them quarters alongside his own pavilion. He then forwarded a despatch announcing his success to Delhi; whereupon they immediately erected festive canopies, and sounded the drum of rejoicing, published the news of the victory [*Fathnámah*] from the pulpits (of all the mosques), and sent the good tidings in all directions. Thus the Kingdom of Hindústán had been fully and completely consigned to the care of Sultán 'Aláuddín, and no rival or competitor for the Government was now left.

Ulugh Khán and Zafar Khán taking the captive sons of Sultán Jaláluddín, both of whom were scions of royalty [*Qáhib i chatr*], as well as their Maliks and Amírs, along with them, set out from Multán towards Dehli, crowned with victory and success. Nuçrat Khán being deputed from the latter place, met Ulugh Khán in the midst of his journey, and put out the eyes of Sultán Jaláluddín's sons, of his son-in-law Ulghú, and of Ahmad Chap Náib Amír Hájb, and then separated their families from them. All their goods and chattels too, provisions,\* and slaves, both male and female, together with all that they had, did Nuçrat Khán seize upon. He confined Sultán Jalálud-

\* Major Fuller's MS. appears to have had *rozínah*. The Ed. Bibl. Indica (p. 249) has *zarrínah*, gold vessels, which seems preferable.

The place where Nuçrat Khán met Ulugh Khán is called in Badáoní (I, 183) Abhohar, a *mauza* near Hání, and the Lucknow Edition of Badáoní (p. 47) has *Wahr*, neither of which names I can trace on our Trig. Survey maps.

dín's younger\* son in the stronghold of Hānsí, while he put to death altogether the sons of Arkalí Khán. As for Malikah Jahán and the other ladies of the household, as well as Ahmad Chap, he brought them all into Delhi, and shut them up in his own mansion.

In the second year of this reign [697, *Badáoní*], Nuṣrat Khán was made Wazír. As Sulṭán 'Aláuddín had sent for Malik 'Aláulmulk, the compiler's uncle, he came to Court attended by the Maliks and Amírs, and brought in elephants and treasure that had been left with him at Karah by the Sulṭán. In consequence of 'Aláulmalik's having grown excessively obese, and incapable of active duty, he gave him the post of Kotwál instead of his former place of Malikulumará, whereby all the able-bodied convicts [*? bandiyán i tázak*] were put under his charge. They also laid hands on the estates [free-holds, *amlák*] and possessions of all the Jalálí Maliks and Amírs, Nuṣrat Khán himself making extraordinary exertions to get hold of their property, and so collecting thousands upon thousands. In fact he brought wealth into the treasury by every means that he could.

In this year moreover, *viz.* 696, A. H.,† an inroad of the Mughuls took place, some of them having crossed the river Sind and entered the country. Ulugh Khán and Zafar Khán with a host of the 'Alái and Jalálí Amírs, and immense forces were nominated to repel their attack; and on the confines of Jarímanjúr the army of Islám had a severe engagement with the miscreants; in which the standard of the true faith proved victorious, many of the enemy being slain or captured, and their heads despatched to Delhi.

After the Multán success, and the capture of Sulṭán Jaláluddín's

\* The Ed. Bibl. Indica and Firishtah have merely *son* (Arkalí?). If Major Fuller's MS. had *younger son* [Ruknuddín] what became of *Arkalí*? Badáoní says, both were handed over to the Kotwál of Hānsí, and 'killed together with the two sons of Arkalí. The women of the late emperor, and his remaining children (*farzandán*) were imprisoned in Dilhí. Ahmad Chap [the Lucknow Edition of Firishtah reads *Habib*], and Alghú Mughul were sent to Gwaliár.'

† So also the Ed. Bibl. Indica. Badáoní and Firishtah have 698. The leader of the Moghuls is called چنلدى (Badaoni, Ed. B. I.), صلدی (Lucknow Badáoní), and Dawá Khán, ruler of Máwaralnahr, by Firishtah (Lucknow Ed.) who adds that he came with nearly 100,000 Mughuls. They were heathens. The place of the battle is called *Jarímanjúr* (Major Fuller), *dar hudúd i Járán Manjúr* (both editions of Badáoní), *dar hudúd i Láhúr* (Firishtah, Lucknow Ed.), and *dar hudúd i Jálindhar* (Ed. Bibl. Indica).

Badáoní seems to have carelessly copied, as a Mughul چنلدى is mentioned below. He has left out the attack on Siwistán.

sons, the coinage of the 'Aláí government had become (to a certain degree) established ; but it was now still further confirmed by this victory over the Mughuls, and the Sultán's power and authority were vastly augmented. Proclamations of the victory were published throughout the city, drums beaten, pavilions erected, rejoicings made, and festivities celebrated. Now that the 'Aláí Government had been thus consolidated, the whole of the Jaláí Maliks, in each town and throughout the army, who had turned their backs upon their master, and gone over to Sultán 'Aláuddín, for which they had received maunds of gold, and obtained various employments and estates, were seized, and while some of them were cast into prison, and kept in confinement, others were [blinded and] executed forthwith. All the wealth that they had received from Sultán 'Aláuddín was confiscated together with their household goods, and property ; their dwelling-houses being converted to the royal use, and their estates annexed to the crown lands, so that nought was left for their children. Their servants and domestics too were placed under the control of the 'Aláí Amírs, and their [military] establishments were completely subverted.

Out of the whole of the Jaláí Maliks and Amírs, three persons only were spared by Sultán 'Aláuddín, and suffered no hurt from him until the close of his reign. First, Malik Quṭbuddín 'Alawí ; second, Malik Nasíruddín Ránah, custodian of the elephants, and third, Amír Jamál,\* father of Qadr Khán. These three individuals did not desert Sultán Jaláluddín and his sons, nor would they take any money from Sultán 'Aláuddín, and they alone remained safe in consequence, while the rest of the Jaláí Amírs were exterminated root and branch.

In the course of this year, Nuṣrat Khan collected by fines and taxes a crore (of money), and lodged it in the treasury.

In the third year of his reign, Ulugh Khán and Nuṣrat Khán were deputed to Gujrát ; whither they accordingly led their army, accompanied by several Amírs and Maliks, and a host of retainers, and commenced ravaging and plundering Nahrwálah [Patan] and the whole territory of Gujrát. Karan Rái of Gujrát thereupon fled from Nahrwálah, and repaired to Rám Deo at Deogír, leaving his wives and daughters† as well as his treasure and elephants to fall into

\* Badáoní has Amír Jamálí i Khiljí.

† ' Among them was *Deval Rání*, with whom later Khizr Khán, 'Aláuddín's

the hands of the orthodox army, who now pillaged the entire country. The idol, which subsequently to Sultán Mahmúd's victory and the destruction of the Manát, had been named Somnát by the Brahmins, and had become a popular object of worship among the Hindús, was also dragged from thence and forwarded to Delhi, where it was trampled under foot by the populace.

Nuġrat Khán next proceeded to Kambáit, from the Khwájahs of which place, who had grown excessively opulent, he exacted bullion, jewels, and other valuables to a vast extent. He also took Káfúr Hazár Dínarí, who became Malik Náib, and with whose beauty Sultán 'Aláuddín was captivated, forcibly from the Khwájah, his master, and sent him to the Sultán.

After thoroughly ravaging and plundering Gujrát, Ulugh Khán and Nuġrat Khán set out on their return loaded with immense spoils, and on the way back, in order to collect their fifth share of the booty, and in searching after and scrutinizing the amount of the spoils, they inflicted various penalties and punishments, and carried their investigation to the extreme; for they placed no credence whatever on what the soldiery put down in writing, but persisted in calling for more. By dint of persecution [*banamak-áb*] they endeavoured to exact the gold, silver, jewels, and all other valuables and used to put the troops to all kinds of torture, till at last the soldiery were unable to bear such tyranny and ill-usage any longer.

The number of newly converted Amírs and horsemen in the army was very considerable; so having entered into a combination, some two or three thousand horsemen assembled together, and mutinied.\* They first slew Malik A'azzuddín, the brother of Nuġrat Khán, who was Amír Hájb to Ulugh Khán; and with a great uproar forced their way into Ulugh Khán's pavilion; but the Khán dreading their fury, escaped out of his tent, and conveyed himself by stratagem to Nuġrat

son, fell in love. When the poet Khusrau of Dihlí was told by the prince of his deep attachment, he composed his '*Ashíqah*, (often wrongly spelt '*ishqiyah*), which he dedicated to Khizr Khán.' *Badáoní*.

The Lucknow Edition of *Firishtah* calls the princess *Kanwálá Dī*. Cowell suggests *Kamalá Devī*.

Karan, according to *Firishtah*, went from Deogír to Baglánah, 'which lies on the frontier of the Dak'hin, but was then attached to Gujrát.' For *Rám Deo*, the Ed. B. I. of *Badáoní* has *Bíramdeo* (?).

\* *Firishtah* calls the leader of the rebels Muhammad Sháh. He says, the mutiny took place at *Jálór* (Jodhpur); but the editions of *Badáoní* have *Alwar*, which lies nearer to Rantanbhúr and Jháyin to the chief of which place, Hamír Deo [Ed. Bibl. Indica, *Hambar Deo*], the mutineers ultimately retreated.

Khán's quarters. The nephew (sister's son) of Sultán 'Aláuddín, however, happened to be sleeping below Ulugh Khán's quarters; and the mutineers imagining that he might possibly be the Khán, put him to death under this misapprehension. The mutiny extended at length throughout the army, and the camp was very nearly becoming the scene of indiscriminate riot and pillage; but as the good fortune of 'Aláuddín was in the ascendant, such a tumult as this even was speedily quelled. The cavalry and infantry of the army formed up in front of Nuçrat Khán's pavilion, and the recently converted Amírs and horsemen dispersed, such of them as had been the chief actors and confederates in the mutiny fleeing away and gaining the disaffected and rebellious Ráis. After this, the search after the booty in the army was abandoned, and Ulugh Khán and Nuçrat Khán reached Delhi with all the wealth, elephants, slaves, and other spoils they had got possession of from the pillage of Gujrát.

As soon as the news of the mutiny among the new converts reached Delhi, Sultán 'Aláuddín, under the influence of the haughty pride which had now inflated his brain, directed that the wives and children of all the mutineers, both high and low, should be seized and imprisoned. This system of seizing upon the wives and children for the fault of the men dates its commencement from this period; for previous to this at Delhi, they never laid hands on women and children on account of the crimes of their male relatives, nor used they to seize and incarcerate the families of any delinquents.

Besides this tyrannical system of seizing women and children, a still more glaring piece of injustice was committed in those days by Nuçrat Khán, who was the originator of numerous acts of oppression at Delhi; for it was publicly witnessed that in revenge for his brother's death, he brought infamy and dishonour on the wives of those who had pierced his brother with arrows, by delivering them over to sweepers to be violated like helpless victims, while the infant children were ordered to be cut in pieces in presence of their mothers.\*

Such cruelty as this that he was guilty of, has never been allowed by any code of religion; and at every fresh act of this description

\* Historians call this wholesale slaughter of women and children *gharīb-khushí*, or killing of the poor. Badáoní (p. 190) says that many historians relate the event before mentioning the return of Ulugh Khán from Gujrát, 'without paying regard to proper chronological order; but God knows best.'

he committed, the people of Delhi were the more struck with profound wonder and amazement [and trembling came over the hearts of the people].

In the same year that Ulugh Khán and Nuḡrat Khán were sent into Gujrát, Zafar Khán was deputed to Siwistán, which (province) had been seized upon by Ḡaldí, and his brother with a party of Mughuls.

Zafar Khán accordingly marched thither with a large force, and having invested the fort of Siwistán, succeeded in capturing the stronghold with the aid only of sword and arrow, and dagger and spear, without having recourse to war engines and projecting machines of a larger kind. The Mughuls, moreover, from the interior of the fort shot arrows in every direction, in so much that it was not possible for a bird ever to approach it; yet in spite of all this Zafar Khán came off victorious by the use of sword and arrow only, and having captured Ḡaldí and his brother, as well as all the Mughuls with their wives and children, he sent the whole party bound, collared, and chained into Delhi.

In consequence of this success, a profound dread of Zafar Khán was established at Delhi, and Sultán 'Aláuddín began to regard him with a malignant eye on account of the hardihood, valour, and gallantry which he had displayed in a manner before unknown in Hindústán. Ulugh Khán, the Sultán's brother, also conceived a feeling of malice and enmity towards him, owing to his consummate generalship, and bravery, which had quite eclipsed his own.

In that year, he (*i. e.*, Zafar Khán) held the territory of Samánah, and as he had become so famous, Sultán 'Aláuddín, who was deeply impregnated with jealousy, was under considerable apprehension regarding him, and anxiously desired one or other of these two alternatives, either that the Khán should be in constant attendance upon him, or else that he should give the Khán some thousand horse, and despatch him towards Lakhnautí to subdue the country, after which he should stay there, and send off the elephants together with his resignation of office\* from thence to Court. Otherwise the Sultán thought of ridding himself of him by administering poison, or putting out his eyes somehow or other.

\* Or rather *with his tribute*, which is the meaning of *khidmatí*. Even in later times transfers to Bengal or to Bhakkar were looked upon as punishments.

Towards the close of the aforesaid year, Qutlugh Khwájah, son of Dúdul'ain,\* invaded Hindústán with 20 "*Tumans*" of Mughuls. Starting from Máwaru-n-nahr fully equipped and prepared for a severe engagement, he crossed the river Sind, and proceeded by regular stages until he reached the vicinity of Delhi.

As the Mughuls this year had determined to attack Delhi, they did not plunder and lay waste the provinces bordering on their line of march, nor do any injury to the strong holds they met with. At the advance of these Mughuls, therefore, with an army as numerous as a multitude of ants or locusts, violent apprehensions were felt throughout Delhi, more especially as the enemy had fixed on that as the main object of their attack, and had abstained in consequence from laying waste the provinces (they passed), and from carrying off plunder. The people of the adjoining districts all flocked into the fortress of Delhi, and the old fortifications had not yet been built up, so that such consternation among men has never been witnessed, nor even heard of; for all the inhabitants of the city both great and small were completely overpowered with terror.

At last such a crowd was congregated in the city, that the people could not find room in the streets, the market places, or the mosques. Everything became excessively dear within the town, and the approach of caravans, and merchants being stopped, the people were reduced to the most pressing want.

Sultán 'Aláuddín then went from the city with great pomp and magnificence, and pitched the imperial Camp at Sírí. The Maliks, Amírs, and other retainers, were next summoned from all quarters to Delhi.

The compiler's uncle, Malik 'Aláulmulk, who was one of the Sultán's confidential advisers, in those days held the office of Kotwal at the Metropolis of Delhi, and the Sultán had entrusted the town, together with the ladies of the royal family and the treasure, to his custody. The Sultán having gone forth from the city with the intention of engaging in a general action, Malik 'Aláulmulk came out to Sírí to bid him farewell, and there, at a private audience, addressed him thus—

\* So Major Fuller's MS. The Ed. Bibl. Indica (p. 254) calls him ذود العین *Zūd ul'ain* (?); Badáoní (Ed. B. I.) *Dáúd*; Badáoní (Lucknow Edition), and Firishtah p. 103 (Lucknow Ed.) *Dawá*, in accordance with the note on p. 189.

A *tuman*, or *tumán* is from 10000 to 12000.

“Ancient Monarchs and former Prime Ministers, who have held sway and sovereignty over the world, have invariably abstained and refrained altogether from tremendous conflicts, in which it is impossible to decide what may happen at any precise moment, as to what side victory is likely to incline; and with respect to encounters between equally powerful chiefs, whereby the state and prosperity of the Sovereign as well as the whole population of the Kingdom are placed in jeopardy, they have recommended that they should be avoided to the utmost extent of one’s power and ability. It is further recorded among the injunctions of ancient Monarchs, that a battle resembles the scales of a balance; for by the prevailing force of a scanty number of men, one scale becomes heavy, while the other gets light. Thus in an instant the affair slips out of one’s hand, passing away so entirely that there is no hope left in one’s heart of its ultimate return or recovery; for although in contests between the Commanders of an army merely, there is not so much danger to be apprehended from a defeat, as the hope of a retrieval is not totally cut off; yet in the case of conflicts between equally powerful chiefs, when a kingdom is staked on a single throw of the dice, Monarchs have always exercised the utmost discretion, and have warded off the event as long as they could by sound judgment and clever diplomacy. Why does your Majesty then purposely and wilfully, and without paying any heed or attention, enter into a perilous crisis, that has ever been avoided by other monarchs as far as possible; when you can push forward Khál Sitari [?]\* who has been authorized to raise a lakh of horse on account of this invasion and encamp with your forces (in the rear)? You may thus delay a few days from engaging these Mughuls, who have poured down upon us like swarms of ants and locusts, and keep procrastinat-

\* Here Major Fuller’s MS. seems to be at fault, though otherwise his MS. would appear to have been as excellent as his translation. The *Bibl. Indica* edition, p. 256, l. 3, has—

*Khudāwand i ’dām mītuwānād kih kohān i shuture (not khāl sitārī) az barāe darāmad i mughul, kih hukm i yak lak suwār dārad, dar pīsh andāzād, ubā lashkarhā farūdāyād.* ‘Your Majesty can place the hump of a camel (*kohān i shuture*) before yourself on account of the arrival of the Mughuls who muster a lakh of horse, and you can place your forces into a fortified camp (*bā lashkarhā farūdāmadan*).’

‘Alāuddīn’s reply will shew that this reading is the correct one. Of course, Alāulmulk advised the emperor to act the part of a *Cunctator*. Placing the hump of a camel before oneself means to have recourse to a place of safety.

“ing, until we discover what they purpose doing, what is going on,  
“and how matters are likely to turn out; when if there appear to be  
“no help for it but fighting, you can do so. As they do not lay their  
“hands on plunder you might gather together your subjects, and  
“place them in security within the fortress. Meanwhile how long  
“can so vast an army as they possess, continue to exist without forage,  
“considering that they never detach ten horsemen even away from  
“their main body, and how will it be possible for them to stand  
“their ground? Or if a few days are passed in sending envoys back-  
“wards and forwards, until we have clearly ascertained their precise  
“aim and object, it will be as well; so that they may come to want,  
“and set out on their return, and devote themselves to pillage. If at  
“that juncture, your Majesty were to march after them a few stages  
“by way of pursuit, how excellent it would be!”

After making this address, 'Aláulmulk went on to say, “I am an  
“old servant, and have always been in the habit of stating to you  
“whatever crosses my mind respecting current events, and I have  
“heretofore ever met with kindness in return. I have therefore,  
“in the present emergency also, stated all that has occurred to my  
“mind; but that alone is right and proper which may have struck  
“your Majesty's discerning intellect; for the illustrious sentiments of  
“a King are superior to those of all his subjects.

“Several ideas have also passed through my mind, relating to the  
“prevention of all invasions of the Mughuls, which I purpose pouring  
“into your auspicious ear at a fitting opportunity. On the present  
“occasion of these miscreants advancing in such formidable array,  
“we have, by God's grace, numerous forces equipped and ready to  
“oppose them. Our army, however, is composed principally of the  
“soldiery of Hindústán, who have spent their lives in warfare with  
“Hindús only, and have never yet joined in battle with the Mughuls,  
“and are consequently ignorant of their cunning system of tactics,  
“their sallies, their ambuscades, and other stratagems. If the Mu-  
“ghuls then through good management on our part retire defeated  
“this time, the soldiery of Delhi will be able to pursue and follow  
“after them, so that (in future) our troops will long with ardour for an  
“engagement with these Mughuls.”

Sultán 'Aláuddín on hearing this address from the faithful Malik

'Aláulmulk praised him highly ; and having summoned all the great Kháns and Maliks into his presence, he made the following speech to the assembled throng.

“ You are all well aware, that 'Aláulmulk is both a 'wazír' and “ the son of a 'wazír', as well as a true and loyal servant to me, “ and that from the first days of my assuming the government up to “ the present time, he has been in the habit of giving me the benefit “ of his advices ; and that it was only his obesity which caused me “ to appoint him Kotwál ; for otherwise he was entitled to the office “ of wazír. At this juncture he has expressed some sound opinions, “ and brought forward arguments to induce me to refrain from “ engaging the Mughuls, and now I purpose giving him my reply in “ the presence of all of you, who are the pillars of my State, so that “ you may all hear it.”

The Sultán then turned towards 'Aláulmulk alone in that assembly and said :

“ O 'Aláulmulk, thou art my confidential servant and ancient sup- “ porter, and hast claims to the office of wazír, and to a large stock “ of wisdom ; hear now from me these clear and distinct truths. “ Long before both you and I (were born), this proverb was in vogue, “ ‘ It is nonsense crouching down (to hide yourself from detection) when “ stealing a camel (as the animal's tall body must necessarily be visible) ;’ “ and in like manner to hold the sovereignty of Delhi and yet hide behind “ Khál Sitári's [a camel's] back as you suggest ; and to assume a menac- “ ing attitude towards the Mughuls, and yet refrain from an engagement “ with them, is altogether impossible ; nor is it feasible to prevent a “ contest with the Mughuls by the vain and idle talking of poltroons. “ Were I to shelter myself in the way you propose, my cotemporaries “ and those men who shall be born after my time will laugh at my beard, “ and will tax me with cowardice ; more especially my foes and advers- “ aries, who may have travelled some 2000 *kos* from their own land, and “ have come under the minarets of Delhi to offer battle. What say you ? “ Shall I under these circumstances be guilty of backwardness and co- “ wardice, and send Khál Sitári to the front [hide behind the camel's back], “ whilst I remain inert like a goose or a hen seated on her eggs, and en- “ deavour to repel them by diplomacy and negociation. And if I should “ do as you say, to whom could I shew this countenance, or how could I

“enter the apartments of my own female relatives? Of what account  
 “too would my subjects esteem me, and what daring and boldness  
 “would the rebellious and disaffected see in me to make them pre-  
 “serve their allegiance to me? Come what may, I am bent upon  
 “marching to-morrow from Sirí into the plain of Kílí, where I pur-  
 “pose joining battle with Qutlugh Khwájah and his army; so that in  
 “the course of this mighty conflict, it may be proved between him  
 “and me, to which of us God intends to grant the victory, and to  
 “which success is to present itself.

“O 'Aláulmulk! to thee have I confided the post of Kotwál, and  
 “the charge of my seraglio, and treasures, together with the whole  
 “town. Whichever of us two, whether he or I, prove the conqueror,  
 “salute the victor with the keys of the gates, and of the treasures, and  
 “lay them before him, and become his obedient servant and vassal.

“Do not you with all your wisdom and ability know this much,  
 “that prudence and judgment can only ward off hostilities so long  
 “as the enemy be not close at hand. Now that he has come  
 “up in hot haste however, no mode of thought or action is left  
 “to me, but to make haste in falling upon him, and to dash out  
 “the brains of my foes with the stroke of battle-axe, sword, and arrow.  
 “You propose pacific measures, but pacific measures are incompatible  
 “with the turmoil of this busy world. The refined and elegant ex-  
 “pressions that you can use (when seated) on the four square yard  
 “carpet of your house, are never taken into the wide world, and would  
 “ill become the field of carnage, where streams of blood shall flow  
 “from either side.

“As for what you say about the ideas you entertain on the subject  
 “of preventing these invasions of the Mughuls, as soon as I am at  
 “leisure from this war, and have fulfilled all the duties attending it,  
 “I will listen to these ideas of your's. You are a literary character  
 “and the son of a literary man, and doubtless your mind sted-  
 “fastly contemplates all these matters, of which you speak to me.”

'Aláulmulk humbly submitted that he was indeed an old servant, and  
 invariably mentioned any suggestion that happened to cross his mind.

The Sultán exclaimed: “You are a truly loyal subject, and I have  
 “always had a high regard for your opinion. Now, however, a crisis  
 “has occurred, in which it is necessary to set wisdom aside, and not

“ a thought or deed is requisite beyond carnage and bloodshed, the  
 “ sacrifices of one’s head and life, unsheathing of swords, and the  
 “ combating with our foes.”

’Aláulmulk then took leave by kissing the royal hand, and having returned into the city, secured all the gates, except the Badáon one, which was left open ; and all the town people, both great and small, were in great dismay, and lifted up their hands in prayer.

*Account of the battle between Sultán ’Aláuddín and Qutlugh Khán, with the (ultimate) defeat of the Mughuls and martyrdom of Zafar Khán and other Amírs.*

Sultán ’Alauddín marched with the army of Islám from Sírí to Kílí, and pitched his camp there ; while Qutlugh Khwájah encamped with the Mughul forces right opposite ; and as two such armies had never been seen in any age or era confronting each other with hostile intent, the people were struck with wonder and dismay. Both armies were then drawn up in line, and stood anxious confronting each other in the coming struggle.

Zafar Khán was in command of the right wing, and he and the Amírs belonging to his division having drawn their swords, made a furious assault on the Mughul force, and fought hand to hand with them. The Mughuls could not withstand the attack, and were immediately broken and routed, whereupon the army of Islám set off in pursuit of them. Zafar Khán, who was the Rustam of his day, and the [hero] of his age, never ceased from the pursuit, but kept following close upon them, and driving them before him [eighteen *kos*] with the [sword, cutting off their heads]. The Mughuls consequently had no opportunity of rallying, and fled in such consternation that they scarcely knew their bridles from their cruppers.

Ulugh Khán, who was in command of the left wing of the army and had several great Amírs, and a numerous host of troops in his division, did not stir from his position, on account of the animosity he entertained towards Zafar Khán, nor would he advance to his support. The accursed Turghí\* meanwhile had laid an ambuscade with his *tuman* [along the Búrújí road?]† and as soon as he saw that

\* He commanded the left wing of the Mughuls. *Firishtah*.

† This is doubtful. The text (p. 260) has *bar taríq i búrújí*, which is opposed to *bar taríq i halqah*, a few lines lower down ; hence *búrújí* must be the Turkish name of a stratagem. *Firishtah* has merely, ‘ he had laid an ambuscade on the

Zafar Khán had pressed well forward in pursuit, and no force was coming up behind to his support, he came in rear of him, and the Khán was surrounded on all sides as if in a ring by the Mughul army. While thus hemmed in by the enemy, who kept firing showers of arrows upon him, Zafar Khán fell from his horse, and thus was that hero of the age, and the Rustam of his time, obliged to fight on foot. Emptying the arrows out of his quiver before him, he overthrew one of the Mughul horsemen with every shaft, till at length in the (middle of the) conflict Qutlugh Khwájah sent him a message saying : “ Come over to me, that I may take you to my father, who will treat you with higher honor than the Emperor of Dihlí has done. Zafar Khán paid no attention to his words however, and the Mughuls seeing that he could not be captured alive, pressed upon him from all sides, and caused him to suffer martyrdom ; after which the Amírs of his division also suffered the like. They then wounded the Khán’s elephants, and slew the drivers of the animals.

That day, under cover of night, the Mughuls managed to make a stand (or recover themselves), but such an astounding dread had been imprinted on their breasts from Zafar Khán’s fierce assault, that they retreated from their position towards the close of the night, and departed to a distance of 30 *kos* from Dihlí, where they encamped. From thence they made [daily marches of about] 20 *kos*, and until they reached the confines of their own country, they never once halted at any stage.

The dread of this attack of Zafar Khán’s remained in their hearts for years ; and if a horse of their’s would not drink water at any time, they used to say : “ What, have you seen Zafar Khán that you will not drink water ? ” and never again after this did so vast an army advance to the environs of Dihli with hostile intentions.

Sultán ’Aláuddín now returned from Kílí, estimating this defeat of the Mughuls by the peerless Zafar Khán, and such a loyal sacrifice of life as his, a most glorious triumph.

In the third year of his reign, Sultán ’Aláuddín did nought but indulge in pleasure and gaiety, giving full scope to the bent of his inclinations, and convoking festive assemblies. His national under-

road.’ The position of Kílí is not given on the Maps ; it could not have been far away from modern Dihlí, *i. e.*, north of Sírí. The Society’s Edition of Badáoní has *Gilí* (?).

takings all turned out well, one after another, and despatches announcing victories were pouring in from all quarters. Every year two or three sons were born to him, and pavilions were erected and festivities held to celebrate the events.

The whole of his state affairs in short were satisfactorily managed agreeably to the utmost wish of his heart. In his magazines he beheld vast treasures, and daily did he enjoy the spectacle of his jewels and pearls, of which he possessed chests and caskets full ; while his eye likewise fell on numerous elephants and 70,000 horses in the sheds and stables in and around the city. He also found two or three vast countries firmly bound under his rule, and the idea of any adversary or rival in the kingdom never crossed his mind.

Intoxicated under all these varied incentives to pride, he began to brood over in his head the grandest projects and most extraordinary schemes, which were neither suited to his capacity, nor indeed to the capacity of a hundred thousand like him ; and such ideas came into his mind, as had never entered the imagination of any other monarch. From his utter intoxication and senselessness, his supreme arrogance and self-conceit, his intense ignorance and infatuation, and his excessive folly and stupidity, he lost all control over himself, and began to conceive impossibilities and absurdities. He was a man who had not a smattering even of education, and had never associated with men of learning ; for he neither knew how to read nor write.

In disposition he was ill-natured, and in temper harsh ; and in his heart was lodged a mass of cruelty. The more frequently the world went well with him, the oftener his enterprizes were crowned with success ; and the more fortune favoured him, so much the more senseless and intoxicated he became.

The object of my (bringing forward) the above peroration is this, that Sultān 'Alāuddīn during these periods of senselessness and intoxication used to say in the presence of his assembled guests, that he had two projects before him, and he used to consult his friends, boon companions, and associates about the furtherance of these two projects, and to ask the Maliks he was intimate with, what he had better do, so as to carry out his plans most effectually.

One of these two projects, which he was always talking about carrying out, was this. He used to say : " God Almighty gave to the

Prophet, on whom be peace, four companions, by means of whose power and influence, he originated the orthodox faith, and owing to the institution of the orthodox faith, the fame of the Prophet has lasted and will continue to last till the day of judgment; and since the time of the Prophet, on whom be peace! whosoever has acknowledged and called himself a Musalmán, has considered himself belonging to his faith and sect. Now, God Almighty has also granted to me four companions; first Ulugh Khán, secondly Zafar Khán, thirdly Nuğrat Khán, and fourthly Alap Khán, who through my favour have attained to princely power and influence. If I like, therefore, I can with the aid of these companions institute a new religious faith, and by the force of my arms and those of my companions, cause all the people to adopt it as the clear way (to salvation); and thus my fame and that of my companions would continue to last among the people, just as that of the Prophet and his companions has lasted."

Impelled by youthful arrogance, and folly, want of judgment, thoughtlessness and audacity, he used to utter the above sentiments at convivial assemblies openly and without reserve, and consult with the chief men of the party regarding the institution of a new and separate religion. He would likewise enquire of such as were present, how he should manage matters, so that his name might continue for ever, and the people adopt the faith that he originated.

Respecting the second project, he used personally to inform those present, that the wealth, elephants, horses, and retainers that he had gathered together were innumerable; and that he would therefore make over charge of Dihli to some one, and starting like Alexander in quest of territorial aggrandizement, would bring the four quarters of the inhabited globe under his dominion.

Another piece of presumption was this. Some of his enterprizes having turned out satisfactorily, he caused himself to be styled "Alexander the Second," in the public prayers and on the coinages. In the midst of his wine-bibbing too, he would boastfully exclaim, "Every country that I conquer, I will give in charge to one of my confidential ministers, and set out myself in pursuit of further acquisitions; for who is there to stand up against me?" The bystanders although well aware that he was perfectly intoxicated, and

demented from the possession of vast wealth, elephants, horses, followers and dependents, as well as from his innate folly, and that he only discussed both these projects out of arrogance, incapacity, and stupidity; yet they were obliged to have a regard for his hasty temper and evil disposition. Through fear of his irascibility therefore, they commended his sentiments, and bringing forward false dogmas and similes as true, they made the application of them conformable to his vile disposition; so that he fell into the idea at last that these impossible propositions that had issued from his senseless heart and tongue, might perhaps be accomplished. The above absurdities, that escaped from his lips at convivial assemblies, were gradually disseminated throughout the city; and while some respectable men laughed, and attributed them to his folly and ignorance, other intelligent persons were sore afraid and said among themselves, "This fellow has the very pride of Pharaoh without possessing a particle of sense; and such immense treasures, as would blind the eye of the wise even, not to mention the foolish and unwary, having fallen into the hands of this idiot, if Satan instil into his mind a mode of faith opposed to true religion, and he, in enforcing its false doctrines, should slay sixty or seventy thousand individuals, what would become of us Musalmáns and our religion."

The author's uncle, 'Aláulmulk, the Kotwál of Dihlí, on account of his extreme obesity used to go and pay his respects to the Sultán 'Aláuddín on the first day of every month only. On the first of one month, when he had come according to his usual custom, and had joined the Sultán's wine-party, the latter asked his advice regarding his two insane projects. 'Aláulmulk had heard from others that the Sultán was in the habit of expressing these sentiments in public, and that the bystanders always corroborated his opinions, and were unable to speak the real truth for fear of his violent and hasty temper. On this occasion however, when 'Aláulmulk heard the Sultán express these sentiments, and demand his advice on the matter, he replied: "If your Majesty will order the wine to be removed from this assembly, and will permit no one to stay with him, but four Maliks, I will lay clearly and explicitly before the throne my views and the conclusion that I have arrived at with respect to these two schemes of your Majesty."

The Sultán accordingly directed the wine to be removed from the assembly, and no one was permitted to remain in it, but Ulugh Khán, Zafar Khán, Nuçrat Khán and Alap Khán, all the other nobles being called upon to retire. The Sultán then said to 'Aláulmulk, "Whatever plan or designs has occurred to your mind for the execution of these two projects, do you now in the presence of these my four companions and of myself explain it, in order that I may proceed to carry it out."

'Aláulmulk prefacing his speech with an apology (for his boldness) spoke as follows : "The subject of religion with its tenets and "doctrines should certainly never be discussed and commented on by "your Majesty ; for that is the duty of the prophets, not of kings. "Religion springs from divine inspiration, and cannot be founded on "human intellect and wisdom. From the time of Adam to the present day, has religion been instituted by the prophets, while kings "have exercised worldly sway and sovereignty ; and since the world "began, is now and ever shall be, the spirit of prophecy has never "been exercised by kings, although prophets have sometimes held "kingly sway. Your humble servant's petition at the throne therefore is this : That henceforth your Majesty will never either under "the influence of wine or without it, speak a word about founding "any form of faith or religion, or such matters as are within the "especial province of the prophets, and which have been finally "determined by our own (last and greatest) Prophet. For, should "expressions of this kind reach the ears of the public generally, the "whole of them will turn from their allegiance, not a Musalmán will "approach your royal person, tumult and sedition will arise on every "side, and vast dangers assail the State, arising solely from such "sentiments as these. Your Majesty may have heard too, how, notwithstanding the torrents of blood that Changíz Khán caused to flow "from all the cities of the Musalmáns, he was unable to implant "among them the civil and religious institutions of the Mughuls. "Most of the latter in fact turned Musalmáns, and professed the "Muhammadan creed ; while not a single Musalmán turned Mughul, "nor adopted their faith. As for myself, I am your loyal servant, "and my life and soul is bound up in your Majesty's existence. "Should sedition arise in the royal dominions, I should neither be

“left alive, nor would my wife and children, my followers and dependents be allowed to exist on the face of the earth. If then I see a means of averting danger from the royal dominions, and I fail to report it explicitly, I should be destitute of feeling for my own life as well as that of my children and family retainers. From these expressions, that have issued from your Majesty’s tongue, moreover, such a tumult is sure to arise, as could not be repressed by the sagacity of a hundred Buzurjmihrs; and those who, professing the utmost loyalty and good will towards your royal person, have heard the above sentiments expressed in various assemblies by your Majesty, and have both confirmed and commended them, have only done so by way of flattery, and have not fulfilled their duty honestly.”

On hearing these words of ‘Alāulmulk, Sulṭān ‘Alāuddīn bent down his head, and became absorbed in reflection. The Sulṭān’s four companions too were excessively pleased with ‘Alāulmulk’s speech, and anxiously waited to see what would escape from the Sulṭān’s lips. After a minute or two, the Sulṭān addressed ‘Alāulmulk thus : “The reason why I have made you my confidential adviser, and shew such regard for you is, that I know you to be a truly loyal subject of mine, and frequently have I perceived and become fully convinced by experience, that in giving an opinion, you always speak the whole truth before me, and never conceal the real state of the case. I have just this minute reflected, and see that everything is as you say. I ought not to discuss these subjects, and henceforward no one shall hear me utter such expressions in any assembly. A hundred mercies rest on you, and on your father and mother, inasmuch as you have spoken the truth before me, and have duly fulfilled the rights of loyalty. In respect to the second project, what say you; is that likewise wrong, or is it proper?”

‘Alāulmulk then addressed the Sulṭān thus on the subject of his second project, which was that of territorial aggrandizement.

“Your second project is one that high-minded monarchs are often bent upon; and it is the custom and habit of these conquerors to desire that they should subjugate the whole world, and bring it under their dominion. Your Majesty likewise with all these vast hoards of treasure, as well as retainers, elephants, and horses, can set forth from your capital

fully equipped and arrayed, and will (doubtless) achieve the greatest feats of conquest. I do not therefore object to the execution of this design, and I am well aware that your Majesty possesses sufficient wealth to enable you to enlist two or three lakhs of horsemen, and conquer the whole world. It would be right, however, for your Majesty to reflect as to whom you could consign the charge of Dehli and its empire, which you have gained at the cost of such vast sums of money, and so much bloodshed, and what force you would give him ; while you yourself departed in pursuit of territorial aggrandizement, and proceeded like Alexander to conquer the habitable globe. For, no matter whom your Majesty might appoint in Dehli or in any other country ; by the time you thought of returning to your own capital again, how could those officers, or those countries have secured peace and safety in these times of sedition and rebellion. The age of Alexander was a totally different era from the present one ; for it was the established usage, and settled habit of the men of that period to adhere strictly and conscientiously to the engagements they entered into, even after the lapse of many years ; and consequently excuses and frauds, falsehood and deceit, and the violation of contracts and agreements were much less frequent in those days. If the nobles and plebeians of any clime or country therefore entered into any contract or agreement with Alexander or any other sovereign, they neither, during his presence nor in his absence, ever swerved from their promise or engagement. Where too, could you find a prime minister like Aristotle ? for all the Greeks, both high and low, notwithstanding their vast amount of population, immense extent of cavalry, and great wealth and affluence, were so attached, faithful, and obedient to Aristotle, placed such confidence in his spoken or written promise, and his strict virtue and probity, and were so well pleased and contented with his administration and rule, unaided and unsupported by considerable forces, that during Alexander's absence not a soul swerved a needle's point from his express order and mandate, nor joined in any revolt or rebellion. When Alexander therefore ceased from his conquest after an interval of two and thirty years, and returned again to his pristine capital, he found the land of Greece tranquil, obedient, and secure ; nor in the course of a generation (*qaran*) moreover, had any disturbance occurred within his ancient kingdom. Very different are

the men of the present time and age, more especially the Hindús, in whom there is not the slightest respect for treaties, and agreements. If they see not a mighty and successful sovereign at their head, nor behold crowds of horse and foot with drawn swords and arrows threatening their lives and property, they fail in their allegiance, refuse payment of revenue, and excite a hundred tumults and revolts. Now your Majesty's territories are the territories of Hindústán; how then will your absence, especially an absence that may continue for years, suit such men as these, who have neither any respect for treaties and engagements, nor any regard for the due fulfilment of promises?"

Sultán 'Aláuddín observed: "Since so much wealth as well as elephants and horses has come into my hands, if I make no conquests, and subdue no new territories, but content myself with the kingdom of Dihlí merely, of what use will it be to me, and how shall I acquire a reputation for victorious achievements?"

'Aláulmulk replied: "I am an old servant, and it appears most expedient to me, that your Majesty should commence upon the two following undertakings before all others; and subsequently set out after the rest."

The Sultán asked, what these two undertakings were, which he ought to commence upon first; to which 'Aláulmulk replied: "One of them is, the bringing under proper subjection of the entire country of Hindústán; so that Rantambhúr, Chitor, Chanderi, Málwah, Dhár, and Ujain, and from the East to the banks of the Sarw, and the Sawálik to Jálúr, Multán, to Damrílah [?], and from Pálam to Láhaur and Dípálpur\* might all become so tranquil and obedient, that the name of rebel never pass from any body's tongue.

\* *Sarw* (سرو *sarw*, or سرء *saro*) is the name of the Western and Eastern Surjoo in the N. E. of Oudh. The Eastern Surjoo is often distinguished as *áb i Bahráich* or *Sarw i Bahráich*, the Sarw on which the town of Bahráich lies. The Western Surjoo is merely called *Sarw*; but the name is also given to the Ghogra. The Ghogra again is often called *áb i Narhan* (آب نرهن), as it falls into the Ganges a little below the town and Parganah of Narhan in Sárán, (North Bihár). In the *Aín* and older books Ghogra is spelt *G'hag'har* گھگر; the modern spelling is گھاگھرا *G'hág'har*, or گھاگھرا *G'hág'hrá*. "The Ghogra joins the Sarw at a distance of one *kos* from Awadh (Faizabád) and passes below the Fort of that town." *Aín*. Abulfazl mentions the *Sarw* among the rivers of the Qúbah of Iláhábád, together with the *Arand* ارند, or آرند *Arand* (*anglice*

“ The second undertaking, which is far more important, is the prevention of the inroads of the Mughuls by strengthening the strongholds in their direction, by the appointment of trustworthy commanders, and the repair of the fortifications, and excavation of the ditches as well as the formation of magazines for arms and depôts for grain and fodder, and the organization of projectile engines of war, with skilful and experienced marksmen to serve them. To this end, a commander should be stationed at Samánah with a large force, another at Deopálpúr, and another at Multán with a body of horse; for in order that the Mughals may be entirely restrained from any hostile attempt on Hindústán, military commanders of loyalty and experience, and a picked and chosen body of troops well mounted, must be depended on.

“ As soon as these two objects, viz. the extinction of the rebellious spirit of the Hindús from the realms of Hindústán, and the appointment of famous and illustrious nobles to the quarters, whence the incursions of the Mughuls take place, have been satisfactorily attained, your Majesty should stay perfectly at ease in the metropolis of Dihlí, which is the centre of the kingdom, and employ yourself with a tranquil mind in state affairs; for the stability of the sovereign in the centre produces stability in the government of the provinces. After the establishment of the paramount power in the centre, and the consolidation of the provinces of the Empire, your Majesty can proceed to territorial aggrandizement without stirring from your throne, by deputing your loyal and confidential servants with well equipped and organized forces, and the faithful nobles of the state, to

Urrunde or Rind), the *Ken* كين (Cane, a tributary of the Jamnah, left bank), and the *Bárnah* نريه (near Banáras).

*Lúhár*, لوهور, and *Luháwar* لهور are archaistic forms for *Láhor* لاهور, just as *Núdíh* نوديه for *Naddiá* ندیا (Nuddeah in Bengal, even now vulgarly called Noodee); *Gálewár* گاليور, *Galewar* گليور, and *Gálewár* گوليوار, for *Gwáliár* گواليار.

Dípálpúr lies on the old bed of the Biáh, between Lat. 30° and 31°, and must not be confounded with the Dípálpúr in Málwah, S. W. of Ujain. Dípálpúr (Deopálpúr), Samánah (in Patiálá), and Multán lie almost in a straight line; hence 'Aláulmulk's advice.

*Pálam* lies S. W. of Dihlí, about eleven miles from it. Under Sultán Mahmúd Sháh (795 to 815, A. H.), people used to say ironically, *Hukm i khudáwand i 'álam az Dihlí tá Pálam*.

For *Damrílah* (?) the Society's Edition has *Marílah* (?). Perhaps, *Narílah*, near Dihlí. What we call *Rintambore* is spelt in all good MSS. *Rantanbhár* رنتنبهوار, not *Rant'hanbár* رنتنبهوار. *Dhár* is in Málwah.

march into distant countries and wage war there; bidding them plunder and lay waste all the territories of Hind, and spare neither the wealth, elephants, nor horses of its kings and princes, but bring them all under the royal subjection, after which their lands and principalities can be restored to them, on condition that they agree to furnish an annual tribute to your Majesty in money, horses, and elephants.”

After giving vent to the above opinions, 'Aláulmulk made obeisance and continued thus: “What your humble servant has recommended can never be brought about, unless your Majesty will refrain from drinking wine to excess, from holding constant convivial and festive assemblies, and from indulging both day and night in the pleasures of the chase, nor until you take up your permanent residence in the centre of the kingdom and allow the affairs of the state, and measures of government to be transacted agreeably to the advice of your faithful and sagacious councillors. Your Majesty's excessive indulgence in wine occasions delay and detriment to all measures, and nothing can be effected conformably to the true spirit of good government; while from your constant pursuit of field sports, there is danger of treason and sedition from deceitful and treacherous individuals, and the royal life is in jeopardy. As soon as it becomes well-known among the populace both high and low, that the Sovereign is absorbed day and night in the pleasures of wine, and of the chase, the due reverence of royalty will no longer remain implanted in their hearts, and the gates of sedition will be thrown open to traitors. If you cannot do without indulging in wine and in the chase altogether, you should drink only after the hour appointed for the second prayers, when you are alone without any party of boon companions, nor should you take so much as to get intoxicated; and for sport, you ought to have a villa erected at Sirí, on all sides of which spacious and extensive plain there should be, where you could take your hawks and fly them. In this manner you should satisfy your longing for field sports, so that the disaffected and ill-disposed characters in the kingdom may not have the opportunity for malevolent designs against you. Your Majesty's life, and the stability of your government are most dear to me; for my own life and that of my whole family and household depends upon the royal existence; and should this kingdom fall into the hand of another, which God forbid, myself, my wife and

children, and my followers and dependants would never be permitted to live."

When Sultán 'Aláuddín had heard 'Aláulmulk's opinions, he was highly pleased with him and said—"The views that you have expressed are decidedly correct, and I will do exactly according to what God has brought forth from your lips." He then presented 'Aláulmulk with a garment wrought in gold with pictures of tigers, a woven waist belt, 15,000 tankahs, two caparisoned horses, and a couple of landed estates. Out of the four Kháns too, in whose presence 'Aláulmulk had continued from early morn till midday explaining his views, as given above before the throne, every one of them sent to his house three or four thousand tankahs, and two or three caparisoned horses. As soon as the above opinions reached the ears of the ministers, officials, and other wise men of the city, they also highly lauded and commended 'Aláulmulk's sagacity and good advice.

This event occurred in the days, when Zaiar Khán had returned from the Siwistán expedition, and had not yet suffered martyrdom in the engagement with the miscreant Qutlugh Khwájah.

Sultán 'Aláuddín resolved in the first place to capture the fort of Rantambhúr, as it was not only somewhat near the capital of Dihlí, but was already encompassed with a besieging force under Hamír Deo, the son of Pathorá Rái. He accordingly despatched thither Ulugh Khán, who held the Biánah district; and directed Nuçrat Khán, who was then Jágírdár of Karah, to move likewise with the whole forces of Karah and the troops of the districts on that side of Hindústán, to Rantambhúr, and cooperate with Ulugh Khán in taking the fortress. Ulugh Khán and Nuçrat Khán having captured Jháyin,\* invested the stronghold of Rantambhúr, and exerted themselves to the utmost in the construction of entrenchments and batteries, while a constant shower of projectiles was kept up from the fort. One of these missiles happened to strike Nuçrat Khán, whereby he was seriously wounded, and after two or three days he expired.

As soon as intelligence of this event reached Sultán 'Aláuddín, he

\* *Jháyin* (جهالین) lies near Rantambhúr. "It is known under the name of *Narshahr*." Bad. I, p. 190. The Society's Editions of Badáoní and Zíá i Baraní have invariably, but wrongly, جهابن *Jhábin*. Vide Elliot's Index (First Edition), p. 193.

came out of the city with the imperial forces and marched in the direction of Rantambhūr.

*Description of Sultān 'Alāuddīn's march towards Rantambhūr, his arrival at Tilpat, and Ikit Khān's insurrection at that place.\**

When Sultān 'Alāuddīn set out from Dihlī with the view of capturing the fort of Rantambhūr, and had arrived at Tilpat,† he halted there for some time, riding out every day to the chase, and indulging in field sports. On one occasion having gone out as usual to the chase, he was benighted, and obliged to take up his quarters in the village of Bādah, where he passed the night. Next day before sunrise he gave orders for a [manœuvre, *nargah*], so the officers of the household, and all the retinue occupied themselves in making the necessary preparations for it, while the Sultān himself took up a position in the open country, when he sat down upon a cane stool (*morah*) with only a few attendants standing round him. The Sultān was thus sitting in expectation of seeing the arrangements for the battle completed, when meanwhile Ikit Khān, his nephew (brother's son), who held the appointment of *Vakilidārī*, raised an insurrection, under the idea and impression that just as Sultān 'Alāuddīn had slain his uncle, and seated himself on his throne, he would likewise be able to slay 'Alāuddīn and ascend his

\* I have written *Ikit Khān*, instead of *Ukat*, which Major Fuller's translation has. *Ikit* is Turkish, and means *jawān*, young, and *Ikit Khān* would thus be the opposite of *Ulugh Khān*, as *Ulugh* means *kaldān*, old, senior. *Khān i Kalān* also was a title in use before the times of Akbar. The usual *scriptio plena* also occurs, *viz.*, ايكيت for ايك، ألغ for ألغ، just as قتلغ and قوتلغ Qutlugh (the same as *Mubārik*), or تغلق and توغلوق Tughlugh (the same as *'alamdār*, standard bearer), or مغل and موغل Mughul (a simple hearted man). Having accident-

ally mentioned the word *Mubārik*, which occurs so often in names, I may remark that it should be spelt *Mubārik* with an *i*, as it is the Part. Active, asking God to bless some one; but inasmuch as the Persians change the final *i* of such Arabic forms to *a*, we may write *Mubārak*. In India the pronunciation *Mubarik* is preferred.

Firishtah calls Ikit Khān *Sulaimān Shāh*. In Briggs and Elphinstone's History the name of *Ulugh Khān* is wrongly given *Alof Khān*.

† *Tilpat* formed the South Eastern frontier of the Parganah of Dihlī; *vide* Beames's Edition of Elliot's Glossary, II. 123. The Nawāb Farīd Khān mentioned by Elliot is Farīd i Bukhārī (Murtazā Khān) who defeated Khusrau. Farīdābād in Balabgarh, south of Dihlī, is named after him, and formed part of *Tilpat*.

For *Tilpat*, the Society's Edition of Bada'oni has *Panhīt* (?), and in a foot note *Sūnpat*, which is a town and Parganah forming the northern boundary of the Parganah of Dihlī; but Firishtah has likewise *Tilpat*.

The place *Bādah* mentioned a few lines lower down, may be the *Mauza* of Bādah, S. W. of the town of Jhārsah. The Parganah of Jhārsah forms the S. W. boundary of the Parganah of Dihlī.

throne. With this design, Ikit Khán, accompanied by several newly converted horsemen of great skill, who were old retainers of his, came headlong upon Sultán 'Aláuddín shouting out, "the tiger," "the tiger," and several arrows were fired by those expert marksmen upon him. It being winter time, the Sultán had on a thick wadded garment [and a *daglah*\*], and when they began to pour down a shower of arrows on him, he got off the stool, and made use of it as a shield to defend himself. Two arrows, however, struck the Sultán, and wounded him in the arm, but neither of them was fatal. There was a servant with him called Nának [El. Bibl. Indica, *Mánik*], who at the time when the new converts were showering arrows on the Sultán, made a shield of his own body for him, and received three or four wounds. The Páik soldiery (foot soldiers) who were standing behind the Sultán also protected him with their bucklers, and when Ikit Khán came up with his horsemen, and they wished to dismount, and cut off the Sultán's head, they perceived that the Páiks had drawn their swords, and were fully prepared to receive them. Notwithstanding the vast tumult and revolt that they had raised, they were thus unable to dismount and lay hands on the Sultán. At this juncture moreover the Páiks called out that the Sultán was dead, and Ikit Khán, being a stupid, foolish, senseless youth, devoid of all tact and intelligence, in spite of the great superiority he had gained in coming upon the Sultán with so many expert horsemen, was unable to give stability to his revolt by severing the Sultán's head from his body, previous to engaging in other affairs; but through his consummate folly, he was too premature and contented himself with the word of the Páiks. [Then he returned and hastened to Tilpat, and rode to the Imperial pavilion.] He then seated himself on Sultán 'Aláuddín's throne, and called out in a loud tone to the royal door-keepers, that he had slain the Sultán. The people also began to reflect, that if he had not put the Sultán to death (as he said), how could he have entered the royal pavilion mounted (*i. e.* in state), or by the aid of what force could he have seated himself on the throne of 'Aláuddín and given audience there. A great tumult and uproar consequently

\* The word *daglah* is not to be found in native Dictionaries, and is but rarely used now-a-days. From the words *qabá wa daglah dar bar dásht*, we may infer that *daglah* is the short ornamented jacket which natives put over the long *qabá*. It has often short sleeves.

arose throughout the camp, and everything began to be turned topsyturvy. The elephants were caparisoned with *haudahs* and brought before the royal pavilion ; the household servants came out, and every one stood in waiting at his proper post ; the sentries kept shouting and bawling out ; the clergy read the Qorán ; the minstrels breathed forth music ; the aristocracy on paying homage offered their congratulations and tendered their services ; and the door-keepers raised the continual cry of “ Bismillah ” (in the name of God).

The wretched Ikit Khán then out of intense folly and stupidity, wished to enter into the interior of the haram among the females, but Malik Dínár, the custodian of those apartments would not permit him ; for arming himself together with his comrades, he took his stand before the door, and kept it securely, saying to the ill-fated Ikit Khán, “ You must shew me the head of Sultán 'Aláuddín before I can let you enter the haram.”

At the time when the Sultán had been wounded by the arrows, all the horsemen engaged in the manœuvre dispersed, and a great disturbance arose among them, every one going off in a different direction, until there were only some sixty or seventy men left with the Sultán. When he recovered his senses after Ikit Khán's departure, they found that he had received two wounds in the arm, and had lost a good deal of blood ; so they washed and bound up the wounds, and slung the arm from his neck in handkerchiefs.

On coming to himself, the Sultán made certain, that the Maliks and Amirs and a vast body of the soldiery in the Camp must be in confederacy with Ikit Khán, or he would never without their support have been able to make such an outbreak.

He accordingly thought of abandoning his Camp and proceeding at once from the spot to gain Ulugh Khán at Jháyin, purposing to march night and day until he reached his brother, when he could adopt any plan that might seem most conducive to the recovery of his kingdom, or could flee from thence to some distant quarter, which ever plan might prove most expedient hereafter.

With this idea, he was about to start forthwith for Jháyin, had not Malik Hamíduddín, the Vakildar, son of 'Umdatulmulk, senior, who was the Aristotle and the Buzurjmíhr of the age, dissuaded him from the measure and said, “ Your Majesty should proceed

this instant to the imperial pavilion ; for all the people in the city and the camp are your loyal slaves and subjects ; and no sooner will the insignia of loyalty come into their view, and the safety of your august person become known to them, than they will repair to your threshold, and bring the elephants before you, and in a moment the head of the traitor, Ikit Khán, will be cut off and fixed on the point of a spear. Should the night, however, elapse without it being made known to the people, that your Majesty is safe and sound, it is probable that some one may join the wretch, and the insurrection become much more formidable than at present ; and after the people have once made themselves his confederates, and pledged their allegiance to him, the dread of your Majesty will compel them to stick to him.”

Sultán 'Aláuddín approved of Hamíd's suggestions, and having mounted at once he set out for the camp. On the way, such horsemen as saw that the Sultán was in safety, joined him ; so that by the time he reached the encampment, about 600 horse had collected in his train. As soon as the Sultán arrived near the camp, he ascended an eminence, and shewed himself conspicuously, so that the umbrella of the Sultán was seen by a considerable number. The concourse at the royal pavilion immediately broke up, and the household with the whole of the elephants repaired to the imperial presence ; whereupon Ikit Khán made his escape through an opening in the tent, and mounting a horse, took the road to Afghánpúr. The Sultán then coming down from the eminence with regal pomp and splendour, proceeded to his own pavilion, and took his seat upon the throne, and gave a public audience.

Malik A'azzuddín Yighán Khán and Malik Naçiruddín Búr Khán [Ed. B. I., *Núr Khán*] undertook the pursuit of Ikit Khán, and overtaking him in the vicinity of Afghánpúr,\* they cut off his head, and presented it before the royal pavilion. By the Sultán's order, the miscreant's head was fastened on a spear, and carried round the whole camp ; after which it was carried publicly through the city of Dehli, and from thence despatched to Ulugh Khán at Jháyin with an announcement of

\* Badáoní (I, p. 193) says : “ *Ikit Khán fled towards Afghánpúr, and a detachment which in forced marches (elghár) pursued him, caught him, and sent him to the Sultán.*” Afghánpúr is either the town and Parganah in Sambhal, or the *maruza* of that name, ‘ which lies three kos from Tughluqhábád ’ (*Badáoní* I, p. 224), where Tughluq Sháh died from the fall of the pavilion. *Vide* also Mr. Cowell's paper in J. A. S. B. for 1860, p. 231.

his victory. The rebel's younger brother, whose title was Qutlugh Khán, was also instantly sacrificed. Sultán 'Aláuddín stayed some days at this encampment, during which he used the utmost rigour and severity in tracing out and apprehending all the agents and horsemen, and those who had had any knowledge of, or connection with, Ikit Khán's revolt. He put them to death under the torture of the iron scourge, confiscated their property to the royal use, and sent their wives and children as captives into various forts.

After having concluded his search after the conspirators engaged in Ikit Khán's revolt, Sultán 'Aláuddín proceeded by continuous marches to Rantambhúr, and pitched his camp at Ran,\* where he executed the surviving portion of the rebels. The siege of the fort had been going on for some time previous to this, on the Sultán's arrival it was prosecuted with still greater vigour. From all quarters of the country, they collected leather skins and bags, and served them out among the soldiery, who used to fill the bags with sand, and throw them into the [ravine] of the Ran. They also made trenches and approaches, raised batteries, and kept up a constant fire of projectiles, with which they harassed and annoyed the garrison, who used to throw down fire from the top of the fort in return, and thus vast numbers were slaughtered on both sides. The army moreover had overrun the district of Jháyin as far as the frontier of Dhár, and brought it all under subjection.

*Description of the revolt of 'Umar and Mangh Khán, the nephews (sister's sons) of Sultán 'Aláuddín, in Badaón and Audh, and receipt of the intelligence at Rantambhúr.*

Just about the time when the Sultán had finished with the conspi-

\* Or rather, on the Ran. Major Fuller's MS. has correctly دران, instead of the absurd دران of the Ed. Bibl. Indica. Akbar also attacked Rantambhúr from the Ran (Bad. II, 107). "On Monday, I inspected the Fort of Rantambhúr. There are two mountains opposite to each other, one is called Ran, and the other Tanbhúr. Though the Fort is on the latter, people call it 'Rantambhúr.' It is very strong, and has plenty of water. The Ran also is a strong position, in fact the only one from which the Fort can be taken. Hence my father [Akbar] ordered guns to be carried to the top of the Ran [Rajab, 976], and had them pointed to the houses in the Fort. The first shot hit the Chaukhandí Mahall of Rái Surjun, which made his heart so tremble, that he surrendered. \* \* \* The houses in the Fort are just as Hindús will build them, narrow and without ventilation; hence I was not pleased and did not stay." *Tuzuk i Jahángírí*, p. 256. During the reign of Akbar, Rustam Khán commanded the Fort for a long time.

racy of Ikit Khán, and had turned his attention to the siege, making his whole army engage zealously therein, news reached him that Amír 'Umar and Mangú Khán had taken advantage of his absence, and having heard of his zealous attention to the siege of Rantambhúr, and the extreme difficulty of capturing it, had broken out into rebellion, and were now collecting an army from the people of Hindústán.

The Sultán immediately appointed certain of the great nobles of Hindústán to coerce them; so that before the rebels had time to do any mischief, they seized both the brothers, and brought them in captive to the Sultán at Rantambhúr. Sultán 'Aláuddín was of an extremely harsh and severe temper, so that he even executed both his nephews himself, and scraped out their eyes with a knife just as he would a piece of a melon, and exterminated their followers and dependents. As for the horse and foot, who had taken service with them, some fled away, and suffered great hardships, while others fell into the hands of the nobles of Hindústán, and were taken prisoners.

*Description of the revolt of Hájí Maulá, (servant of) Malik ul Umará Fakhruddín Kotwál.*

The Sultán was still engaged in this siege of Rantambhúr, and had his whole army zealously employed in it, when Hájí Maulá i Malik Fakhruddín,\* the former Kotwál, raised a revolt in (Dihli), and caused a very considerable commotion; intelligence of which reached the Sultán at Rantambhúr on the third day. In the course of this insurrection, the people of Dihlí, and of the royal camp, were completely upset; for the above mentioned Hájí was a man of the most sanguinary, audacious, and depraved disposition. In these days, while the Sultán with his whole army was occupied at Rantambhúr, where a large number were being constantly killed, and the soldiery in consequence were sorely distressed, Hájí Maulá held the office of superintendent of the crown lands of Ratol.† A person of the name of Tirmidí was the Kotwál, and he was engaged in building the Badáon gate, and near this gate on the inside he had erected a private domicile, in which he resided, while for the transaction of the official business of the *vizárat*, sheds [*chhapparhá*] had been put up in the plain of Sirí, where all public

\* The final *i* in *Maulá i* is the *Izáfat*. Firishtah and Badáoní call him a *servant* of Fakhruddin, which his name *Maulá* (freed slave) also implies.

† Perhaps correcter *Tol* or *Bartol*. Major Fuller takes the first letter as the Persian preposition *ba*, though we expect *bar*, which the Ed. B. I. has. The place is not known to me.

affairs were settled. 'Aláuddín Ayáz, the father of Ahmad Ayáz, held the post of Kotwál to the New Fort [*Hiçár i nau*]. The aforesaid Hájí Maulá then saw that the city was thus left vacant, and that the people were grumbling and complaining of the tyranny and oppression of Tirmidí the Kotwál, while constant reports were coming in of the distress of the soldiery employed in the siege of Rantambhúr, and the numbers of them that were being killed, so that the mass of them were reduced to the greatest extremity, though for fear of the Sultán's laying a fine of three years' pay upon them, it was impossible for any one to get away from the Camp—Hájí Maulá therefore, fancying, that in their distress the people of the Camp as well as of the city would stand by him, made friends of all the former Kotwáls, raised a very considerable insurrection, and kindled a conflagration, the flames of which blazed up to the skies. About midday in the month of Ramazán, during which Ramazán the sun was in Gemini, and people to avoid the heat of the weather had retired into the interior of their domiciles and were enjoying a siesta, and the number of people passing to and fro in the streets was consequently but few; Hájí Maula entered the Badáon gate with a forged warrant under his arm, and accompanied by several foot soldiers with drawn swords, took his stand in front of the Kotwál Tirmidí's private dwelling. On pretence that he had come from the Sultán and brought a warrant from him, he summoned the Kotwál, who was taking a nap, and had none of his guards or others about him, to come out of his house to the doorway. The Kotwál accordingly rose from his couch, and slipping on his shoes, came out to the door; but no sooner did Hájí Maulá catch sight of him, than he he ordered the páiks to sever his neck and cut off his head from his body. He then took the *Tughrá* warrant from under his arm, and exhibiting it to the bystanders, he exclaimed, "By virtue of this warrant have I put the Kotwál to death," at which the people remained silent. He next ordered all the gates, that were under the Kotwál Tirmidí's charge, and the guards of which had espoused his wretched cause, to be shut, and the door of every house throughout the city was kept closed.

After slaying the Kotwál Tirmidí, the above named Hájí sent for 'Aláuddín Ayáz, the Kotwál of the New Fort, with the intention of killing him as well. The message he sent him was this: "I have

brought a warrant from the Sultán; come over and hear its contents." A confidential friend of this Kotwál's, however, among the conspirators, gave him warning and informed him of the intended reachery, so he refused to come, and keeping vigilantly on his guard, had the gates of the new fort strongly secured.

Hájí Maulá with the other conspirators then repaired to the palace, and having seated himself in the raised balcony of state, he released the whole of the 'Alái prisoners, some of whom joined his cause. He also took out bags of money from the treasury, and begun to squander it among the populace. He likewise presented the rebels with arms from the magazine, and horses from the stud; and whoever became his ally, had his lap filled with gold.

There was a Sayyid, who used to be called the son of Sháh Najaf, and on his mother's side was descended from Sultán Shams-uddín. To this poor wretch's house, Hájí Maulá proceeded on horseback with a large retinue, and bringing him by force to the palace, placed him on the throne. He also compelled all the grandees and nobles to come from their homes, and do homage to their Sayyid, and offer him their allegiance.

Thus from time to time he kept kindling the flame of turbulence, and some ill-fated wretches, whose hour of death had arrived near at hand, used from avaricious motives to come willingly and cheerfully to him, and he conferred on these rebels all the royal appointments, and paid homage himself. From fear of Sultán 'Aláuddín, and their dread of this miscreant, the people abandoned both sleep and food; and passed their days and nights in the deepest anxiety.

During the week that Hájí Maulá excited this revolt, news of it was several times received by Sultán 'Aláuddín; but the intelligence was never explicitly divulged throughout the camp, and no tumult arose from it.

On the third or fourth day of the Hájí's insurrection, Malik Hamíduddín Amír Koh, attended by his sons and relatives, every one of whom was a roaring lion, forced open the Ghaznín gate, and entering the city, made for the Bhandarkal gate, whereupon a distant conflict with arrows was commenced between them and the rebels. On such an occasion, the covetous and avaricious naturally set their lives on the palms of their hands (*i. e.*, recklessly exposed themselves to

danger), and received large donations of money from the Hájí; but after two or three days Malik Hamíduddín Amír Koh, and his sons, who were a most loyal, true, and faithful crew, got the better of the rebels. Some of Zafar Khán's comrades too, who had come into the city from Amrohah for the purpose of presenting a petition, joined the Malik Amír Koh and his sons. The latter then entered from the Bhandarkal gate, and a close combat ensued between him and Hájí Maulá in the shoemaker's quarter.\* The Amír koh having dismounted from his horse, and thrown Hájí Maulá down, sat himself on his chest, and notwithstanding all the cuts that the Hájí's retainers showered upon this valiant and loyal hero, and the number of places in which they sorely wounded him, he would not stir from his place on the Hájí's chest until he had slain him.

After his death, the supporters of 'Aláuddín repaired to the Lál palace, and having severed the head of that senseless Sayyid from his body, and carried it round the city on the point of a spear, they forwarded it to the Sultán at Rantambhúr with a despatch announcing the victory and Hájí Maulá's demise.

Notwithstanding the many tumults and revolts that were reported to Sultán 'Aláuddín as having taken place at Delhi, and completely subverted that city; inasmuch as he had fixed his imperial mind upon the capture of the fort of Rantambhúr, he would not stir from this place, nor turn his face towards Delhi. Notwithstanding the large army too, that was engaged in the siege, and reduced to such distress in every way, not a single horseman or footman through fear and dread of Sultán 'Aláuddín, dared turn his face towards Delhi, or go elsewhere.

In short, in the course of five or six days, whosoever in the city had been a confederate of Hájí Maulá, and had taken money of him, was seized and imprisoned; and all the money that he had taken out of the treasury and distributed among the populace was fully recovered and replaced in the treasury. At the end of a week, Ulugh Khán arrived by express from Rantambhúr, and entering Delhi took up his quarter at the palace of Mu'izzí. They then brought all the rebels before him and he executed the whole of them, making a torrent of blood to flow.

\* The Society's text has *dar miyán i mozahdozán o miyán i ú o miyán i Hájí Maulá*. Major Fuller's MS. has no *and* before the second *miyán*.

On account of these rebels too, he put mercilessly to the sword, as a warning to others, the sons and grandsons of Malikulumará, the former Kotwál, who had no knowledge at all of the insurrection, together with every surviving member of his family and his attendants, and would not permit their name even to exist in the world. (Ed. Bibl. Ind., p. 242 to p. 282.)\*

\* The Persian text of this portion of the translation of 'Aláuddín's reign has four doubtful words, viz., اختر زر Ed. Bibl. Ind. p. 243, l. 8 from below ; تازی p. 250, l. 3 ; امرج p. 252, l. 12 ; بوروجي p. 260, l. 9 from below.

*Addenda.* P. 200, note. Regarding *Kílí*, vide also Bad. I., p. 233, l. 7.

P. 187, first note. There is some confusion regarding the word *Kúchí*. Badáoní (I., p. 180, l. 3) says that Fakhruddín i Kúchí, who was Dádbeg under Jalál, was killed with Jalál at Karah ; and Júná cannot well be the son of Ghází Malik (Tughluq Sháh).

The misprints in the Society's edition of the *Tārīkh i Firūz Shāhī* are rather numerous in the lists of office-bearers prefixed to each reign, though the edition is on the whole good. Ghází Malik is especially ill-treated. Thus on p. 240, l. 3 from below, the asterisk is to be put after غازي, and for *Shaikhák* (?) we have to read *Shihnah beg* شهنه بك ; and on p. 379, l. 6, the same correction is to be applied to *Shihnak* (?). *Shihnah Beg i Bárgáh* is the same as *Bárbeg* باربك, i. e. the Beg of the Court. That *Beg* was formerly pronounced *bak* or *bik* is clear from the names of towns, as *Bárbikpúr*, *Bárbikábád* (cf. Wazírábád, Khánpúr.)

(*To be continued.*)

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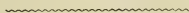
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Temple in the Lar Parganah, Kashmir.

Photocncographed at the Surveyor General's Office Calcutta,

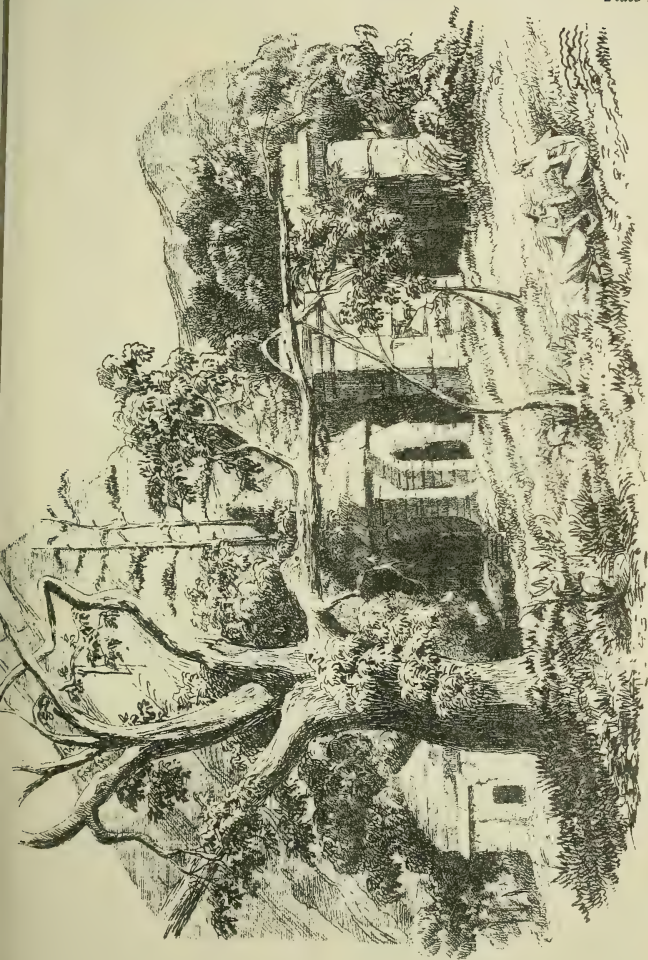




Temple in the Lar Parganah, Kashmir.

Photographed at the Surveyor General's Office Calcutta





Temple in the Lar Pergana, Kashmir.

Photographed at the Surveyor General's Office Calcutta.



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OF THE

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“It will flourish, if naturalists, chemists, antiquaries, philologists, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease.”

SIR WM. JONES.

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# JOURNAL OF THE ASIATIC SOCIETY.

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## PART II.—PHYSICAL SCIENCE.

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No. I.—1869.

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NOTES TO ACCOMPANY A GEOLOGICAL MAP OF A PORTION OF THE KHASI  
HILLS NEAR LONGITUDE  $91^{\circ}$  E. ;—by Captain H. H. GODWIN-AUSTEN,  
F.R.G.S.

[Received 28th January, 1868.]

In contributing this paper to the Journal of the Asiatic Society, it will be first necessary, as an introduction to those unacquainted with these hills, to commence with a brief account of the geology already published; this must form the base of all further inquiry extended into portions hitherto unvisited. I cannot, therefore, do better than briefly quote from the works of Thomas Oldham, Esq., Superintendent of the Geological Survey, and H. B. Medlicott, Esq., Deputy Superintendent in the same Department. These able surveyors, by their researches in the neighbourhood of Cherra Poonjee, have determined the superposition of the principal formations as displayed there, and though many minor sub-divisions have, no doubt, yet to be discovered and worked out, the main divisions on this longitude will most probably remain as the above geologists have laid them down. Mr. Medlicott in his report on the Coal of Assam, &c.\* commencing at page 34, after mentioning the trap and metamorphic rocks north of Cherra, gives in detail an ascending series of the stratified rocks. These he divides into three great Sections, as follows :—

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\* Mem. Geol. Surv. of India, vol. IV. p. 387 etc.

*First and lowest* ; the coarse sands and conglomerates, resting on the trap and metamorphic rocks.

*Second* ; the rough tabular sandstone of the Cherra plateau, with all the beds between it and No. 1 ;—*Cretaceous*.

*Third* ; the limestone, sand and shale with coal, that rise on the west of Cherra, forming what is locally known as the coal-mine hills ;—*Nummulitic*.

Of the oldest rocks the trap, as one proceeds northwards, is the most conspicuous, and as shown in Mr. Oldham's geology of the Khasi Hills is in great force in the bed of the Kalapani, and Bog Pani rivers. It is seen for the last time beyond Mofflang on the road to Mairang, and in the bed of the stream from Mofflang near Langiong, on the road to Nongspoong. A rough section as observed on a march from the Boga Pani, in this latter direction, appears as given in section a, pl. I. The unaltered position of the sedimentary sandstones, and grits resting on the trap, and the great difference of level and exposed surface of the last, with the high dip of associated metamorphic shales and older sandstones, show a very decided unconformity and lapse of time between the two formations, as well as the prior contortion of the metamorphic shales on the first upheaval or depression with the trap.

The sudden and final termination of the nearly horizontal stratified rocks, is nowhere better seen, than on the road between Lookla and Langiong ; this would strike the most unobservant traveller, more particularly if he were coming from the northward. From the great northern scarp to the Lookla valley all is metamorphic rock, gneiss or granitic formation ; giving the usual peculiar features to the country of humrocky rounded hills, steep falls encumbered with enormous weather-worn masses of granitoid rocks, and many a grassy hill capped with a dark grey, single or double boss of the same. To the geologist the only sections exposed shew an interminable succession of coloured soft-bedded gneiss, always dipping at a very high angle, and of a regular strike which has given a like parallelism to the natural features of the country, its ridges and drainage lines.

On marching from north to south, and arriving at the village of Púmsúngút situated on the ridge, that bounds the valley of the Um Lookla, the change is most sudden ; one walks off the dark grey granite on to a perfect shingle beach, and topping the ridge at the

same time, the eye looks over a new land of high flat plateaus, showing at once their regular superposition, and notwithstanding the great elevation, their undisturbed state ; even if the lines of bedding that show in the steep cliffs of the ravines were absent, to strengthen the impression. To the south-west rises the steep scarped hill of Maosinghi, an outlier of another long high plateau to the south ; this is to a certain extent evidence of still newer deposits, mostly swept off by the all-powerful forces of denudation. The boundary of the beds first seen at Púm-súngút follows this ridge eastward towards Mofflang, these beds being at first very thin, from lying and abutting on the denuded southerly slope of the older rocks. The road towards the Bogapani, descends into the valley running towards Langiong, and the whole series is here well displayed, the most striking feature being its exceeding coarseness. Thick, irregularly bedded conglomerates of metamorphic rocks, are very equally associated with the very coarsest grits of quartzitic material. These are seen (Section A, pl. III. resting, first, on the granitoid rocks, and then on thin-bedded soft micaceous and pink-tinted schists, and in the bed of the stream below, on the dark green, or blue coloured trap, the extreme northern limit of a rock of which Mr. Medlicott in his report says :—"I have never seen, not even in Central India, such extensive phenomena of trappean intrusion."

From the great preponderance of shingle and water-worn stones in the beds around the valley of the Karamjoimai, the cliffs that were formerly cut away and bounded its sides, are now covered up for many yards in extent by a shingly gravelly talus ; the old scarp only showing here and there at intervals. The quartzitic nature of the materials, as before mentioned, gives these slopes a very light colour, and to the country a very peculiar and uncommon appearance, the ground being so stony that hardly any grass grows on it.

The level of the opposite plateau, bounding the right bank of the Bogapani, is very nearly the same as that on the south of the deep gorge of that river. It is very noticeable, as one proceeds south, that the sandstones become finer, the bedding more regular, and thicker, until at last, the conglomerates are replaced by coarse grits, and the mass of the beds by hard and rather fine sands, some very white ; even beds of a clayey nature are occasionally seen. North of the Boga Pani, I noticed no trace of any carbonaceous shales, which I had

at first expected to see, the series appearing so continuous with the sandstones of Maobelurkur, where coal is found, and even worked, but I think now there is enough evidence to show that a line can be drawn between the lower and coarser beds, and the upper finer ones with coal. The manner in which the general denudation has acted, indirectly proves this; the lower, older and therefore harder beds remain, withstanding this force, while the higher and softer have disappeared fast and over a larger area. Extending through the whole mass of the beds, there is a very perceptible tendency to thin away at a very low angle towards the base of the main ranges, *i. e.* southward, and at the same time to thicken, I believe, quite as much in the lower series as in the upper. This, with irregular bedding, renders it very difficult, without the closest scrutiny, to be certain of the exact portions, as the conglomerates resting on the granite incline to the beds with coal at Maobelurkur. The coal itself is very local in its distribution. We see at Cherra how soon it fines out and almost dies away on the road towards Surarim.

The conglomerates in the valley near Langiong, bear in their composition a close resemblance to the great thickness of like rocks seen below the cretaceous beds above Nongphriam, in the deep valley, east of Cherra Poonjee; and I think they are, in both these positions, the lowest in the series. Should this view be correct, the greatly denuded patch of sandstones that form a higher plateau west of Púmsúngút, together with Mao Shinghi Hill, &c. are the representatives of the higher beds, forming a part of the nummulitic series, the coarse grit and conglomerate being the very lowest of the cretaceous rocks; the well developed later beds containing fossils only come in with their increased thickness further south, but on this latitude they are absent.

I have not had the leisure or opportunity of examining any of the country adjacent to Cherra Poonjee itself. It has been examined by far abler and professional geologists; I will therefore, make no further remarks in connection with this area into which I had begun to wander. In the section through the Bogapani, a series of schistose, yet sandy rocks is seen in close contiguity to the trap, and it occurs successively in two valleys. No like formation is to be found among the series of the sedimentary rocks, that have retained their almost normal position; they are quite distinct, and seem to form the oldest trace of a much earlier

stratified formation, indurated, altered, and much disturbed by the trap. I think their extension east, and their counterpart is to be found in the quartzite sandstones of Moflang and Shillong, associated with gneiss, and to all appearance merging into this rock, which is in all respects similar to that seen towards Nunklow, Kollong, &c.

Having endeavoured to give the reader an insight into the class of rocks and general characters of the country to the edge of the great granitoid centre of the Khasi Hills, I will, in proceeding to the portion in which my map (see pl. IX.) and sections were made, sketch the general topographical features adjacent to the route.

On this side of the Khasi Hills, the highest and most conspicuous feature is the Maotherichan ridge, the highest point of which, the trigonometrical station, is 6,297 feet above the sea. It is in fact the backbone of the range, throwing off its streams into the Brahmaputra on the north, and the vast jheels of Mymensing on the south. From the extreme northern point in section A (pl. III.), proceeding towards this central mass, the country is open and bleak, covered with grass, only some of the northern faces of the hill being sided and sheltered ravines, with a shrubby jungle. The Khasi Pine must have been once abundant, but has been so indiscriminately felled, that its southern limit is much contracted; it is fast disappearing along this line, and calls for Government interference and protection. The jungles are of sufficient extent near Nowgspoong, to supply the large quantity of charcoal, used by the iron smelters there. The whole process of extraction of the ore, found in the state of small grains of titaniferous iron, is fully described in Oldham's geology of the Khasi Hills; it gives employment to a large number of the inhabitants. The rivers Um Laokla and Um Nongspoong, are large broad streams, and shew that they are heavily swollen during the rainy months. Before reaching the southern foot of the Maotherichan ridge, a much larger river, the Um Kainchi is crossed, flowing through a broad flat valley, generally well cultivated with rice. These broad flat valleys are a very characteristic feature of the drainage lines in this portion of the hills, and some especially that of Mokasa, give the idea of a former lake system, before the sluggish rivers that flow through them, cut the present deeper channels. Under the ridge of Maotherichan, in the last named valley, the very regular strike and high

dip of the gneiss is very marked, in a white coloured soft band that crops out at the very base of the hill, and is continued E. S. E. past the village of Laoburtun.

From all I could see of this formation here, the Mokasa valley, lies on a very sharp anticlinal bend of those gneisose rocks, the granite appearing to curve over the Maotherichan ridge.

Mokasa. Maotherichan, G. T. Stat. :



Ideal Section looking West, near Mokasa.

The rock near the summit of Maotherichan is very porphyritic, containing large oblong crystals of felspar. In the valley it disappears, and coloured gneiss, soft and friable, comes in, to which is very probably due the present configuration of the valley. To the south near Mahaton, the porphyritic granite is again seen, with a corresponding rise in the hills. The above kind of granite is very common about here, forming as a rule the lines of the higher ground and elevated masses; it is of a very hard nature, often pink, and is generally used by the people for the monoliths set up beside the ashes of their dead.

On and about the summits of the low hills, south of Maotherichan, that rise some 150 feet above the present level of the rice cultivation, or what was originally the bed of a lake, I was surprised to find, scattered over the surface, a few well water-worn pebbles, mostly of a hard quartzitic rock. No beds exist anywhere near from which such well-rounded pebbles could have been washed, and I was quite unable to account for their appearance. They were not numerous, but sufficiently so to preclude the possibility of having been carried there by human agency, the nearest spot whence they could have been brought was the bed of the valley below. No well marked traces of any

thing like glacial action are apparent. Equally puzzling in such valleys are two or three low mounds, all of transported material, that are to be seen at the eastern and upper limits of the Mokasa valley. I may ask, can even these hills have been affected by the glacial period in the Himalayas? On this supposition, long and deep snow beds extending down the flanks of this ridge, would be quite sufficient to account for the above appearance, without the intervention of true ice streams, but cold sufficient, to cover them deeply in snow, during the winter is by no means an improbable state for them to have passed through; and we have no reason to suppose, that their mean attitude has altered since the time when Himalayan glaciers extended down to 5,000 feet below their present limits. Such a physical change in a mountain range so close on the north, must have wrought a perceptible one on the highest parts of an outlier like the Khasi Hills.

Fifteen miles to the west of Maotherichan the higher general level of the hills, some 4,000 feet, comes to a rather sudden termination; and the central main water shed takes a bend to the N. W. Rising again, there in another higher portion called Laobersat 5,400, and Nongkana 3,726; overlooking the northern slopes that thence fall very rapidly towards the Assam valley. The watershed is thus brought very close to the northern face of the hills, almost the whole drainage being thrown to the south. The great depression west of Nongkana in the main axis of the range extends quite across them, the highest part the ridge near Nongkulang rises only 2,000 feet on the south, forming there a kind of natural wall, between the main drainage and the plains of India, the Um-Blay cutting through it near Púna Tith. The cause of this sudden fall in the levels of the country, I would suggest, is neither due to subsidence of the metamorphic rocks, or to their denudation, but that this portion has remained in a more tranquil state, and been less affected by the changes of level, on the west and east, particularly in the latter side, where the intrusion of the trap rocks alone has played so important a part in the present elevation of the whole series. As we shall see, this trap rock entirely disappears on this more western longitude, and in the sections (see pl. III.), I propose to explain, the stratified rocks are seen but little disturbed; whereas with the proportionate rise in the

hills, on either side is to be seen an equal bending and displacement of the strata at their base.

Nongstoin, the residence of the Seem, or native chief of that name, is situated near the edge of the general fall, towards the west and south. A road leads out into the western part of the Nongstoin state, viâ Nongsingriang. Crossing the Kerkonshiongba river, 400 feet immediately below, its bed is seen cut through the metamorphic rocks; thence ascending to the plateau on the other side, the village of Nongrompoi is reached. This part loses fast the open bare features of the Khasi Hills, large timber trees come in, with densely wooded ravines, principally bamboo, until with the descent to the Umiam river and the village of the same name, this jungle growth becomes so dense, that nothing can be seen of the country on either side of the path. The scenery in the above valley is very lovely near the river, fine trees on every side overhang the still winding reaches of the Umiam. To the traveller it is both striking and novel scenery. It was only in the beds of streams that the rock *in situ* could be seen; this still continued to be of azoic age. Turning S. W. up, over and down low ridges covered with the same monotonous jungle of bamboo, grasses, and shrubs, Maomarin was reached, and a short distance to the west is Nongkúba built on a clearing at the south side of a hill, called Lamdekar in the map (properly Lúmdellor, Khasi) conspicuous even at Nongshingring from its sharply cut, though low scarp. On this hill is the site of one of the principal trigonometrical stations of the Khasi Hills Survey, and this led to my obtaining an insight into the formation. Nongkúba stands on a hard hornblendic gneiss, slightly pink in places, with a certain amount of bedding, the dip being very high to the north; it was of very compact grain and different to the same class of rocks hitherto seen in the East.

On leaving the base of Lamdekar Hill, at the very commencement of the ascent, is met a dark blue grey, and coarsish grit, having scattered water-worn pebbles of quartzitic rock in it. At the next portion of the ascent and the main one to the summit, these pebbles are not seen, but the same coloured grit, very conspicuous from its extreme neutral grey colour, occurs as a thick bed of quite 14 feet. This is succeeded by beds of a lighter colour, but still coarse texture. Higher again it changes to a bed of

extremely coarse subangular quartzitic grit, set in a white sandy matrix. The whole thickness would be up to this point about 150 feet of horizontal bedding. Here a very fine grained series of beds comes in conformably. In this occurs a dark carbonaceous shale from two to three feet thick, shewing on fracture indistinct traces of carbonized wood and vegetable matter; it was very fine and soft, with few mica grains here and there. The colour is of a dark indigo, approaching to black in places; the little carbonized bits of wood still showed the fibre. The beds above this I could not see in section, but quite 30 feet or more, cap the hill. A great deal of loose stone lies about, and also shaly white fine clays and fine sands, more or less micaceous. The sands are thin-bedded, white and pink, some beds being composed of a finer material of a light blue colour, and full of minute bits of blackened vegetable matter. On splitting several of the slabs, I disclosed some very perfect impressions of large well developed leaves. The greater number of these were evidently of grasses, as large as bamboo, and interlaced over and under each other.

The Lumdekorh hill has no great area on the top, it is perfectly isolated, and another small hill of the same formation stands to the N. W., about 400 yards off. For 40 feet it falls in a cliff, and thence in steep latus the rest of the height; but owing to the dense jungle, it is almost impossible to examine the cliff. The Garrow hills rise rather abruptly on the S.W. into long flat-topped hills, having no conspicuous eminences, and are covered with forest; they so vary in height that no particular tree can be selected anywhere on their crests, that might serve, when observed from some other station, as a point for the detail Surveyor. Deep ravines proceed towards the plains, cut through horizontally stratified rocks. On the south rise two eminences of the same type as Lumdekorh, and in one and the same true line, due N. W.—S. E. It is curious to find these isolated masses, the last remnants of a higher level of the formation, still remaining, when all else has been removed. To the east of Nongkúba village, a hard hornblendic gneiss was seen, and the same rock extends towards Maomarin. A short distance before reaching this place, the path towards the south diverges, passing the site of the deserted village of Umlangyem.

Eight minutes walk along the ridge S. W. of this brings one upon a sheet of the coarse sandstones, resting on and capping the gneiss; not more than three feet of the sandstone remains visible; it is no doubt the same as the lowest beds seen at the base of Lumdekorh. Passing over this little outlier the ridge falls, and the metamorphic rocks are again traversed all the way to Nonglalay; the path crosses one large stream, and on the descent into this valley, much milky quartz is seen, evidently in thick veins. Close to Nonglalay, rises one of the eminences noticed at Lumdekorh. The lowest beds were precisely similar to those previously noticed. In the scarp, near the top, a few very dark beds gave indication of the presence of the carbonaceous and upper beds, which I have already described. Unfortunately dense jungle and want of time, prevented my paying a visit to the summit of the hill. From Nonglalay the country is seen to fall gradually towards a deep valley on the south. To the south-east again, the second isolated mass Katelao was seen, its scarped features are the same as the one we were under. This last also threw off spurs towards the deep valley of the Um Blay. Down towards this our path wended, following a long broad spur. About two miles down, I came on a thin capping of coarse sandstone, with sub-angular quartz pebbles, the position being due west of Katelao hill. The sandstone was evidently dipping away south together with the level surface of the metamorphic rocks. We thence rather more rapidly descended into a deep valley on the right, the Teniang, backed by a high wooded scarp, the stream flowing through beds of coarse sandstones and conglomerates, being nearly horizontally bedded. The forest is here very fine, the bamboos of enormous length, the tallest certainly I have ever seen. Crossing the Teniang, the path ascends steeply to the top of the plateau, and descends again a considerable distance, suddenly opening out of the forest upon the high bank of the broad fine river, the Um Blay. Sandstone is seen all the way to this. On both of the intervening ridges, or rather plateaus, one sandstone bed of a very blue colour was conspicuous, the tint generally was precisely the same as that of the beds noticed at Lumdekorh, but here the series had become of very considerable thickness, from 800 to about 1000 feet.

The way looking up and down the Um Blay, was very pretty, as regards its wooded character. The river was nowhere under 100 yards in

breadth, flowing very sluggishly ; in its bed the sandstones had a southeasterly dip of about 5 degrees. A ford was formed about a quarter of a mile down, it was water knee-deep, but a very small fall of rain would have rendered it quite impassable. At the junction of a tributary from the south-west a short distance further down the right bank, the path leaves the Um Blay, and follows the new stream. In the bed I at once noticed rolled pieces of coal. Sandstone of the coarse purple kind was exposed in thick beds on the ravine side, dipping south with 7 degrees ; and further up, the coal occurred in water-worn lumps quite 2 lbs. in weight, its fracture was bright. At half a mile the path leaves this ravine on its left bank, continuing steeply through a magnificent forest with very little undergrowth. As one ascends, the sandstones become finer and lighter, and at about 400 feet in a side ravine with water coal again was noticed in its bed, showing that it lay high in the series. Leaving the path, I struck up the steep ravine, which gave every promise of a good section being obtained, and it has well repaid the trouble of the climb, for at 50 feet of vertical height, coal was found. It rested on ferruginous coarse sands, and was overlain by a coarsish white quartz-grit, with a few little dark discolorations here and there. I am not over-estimating the thickness of this lowest bed of coal at six feet, and in places it was more ; the bedding was irregular. On a like surface of the strata below it I commenced here to take in the whole of the measurements with a 10 feet pole, well knowing how very wild some estimates have been, especially with regard to coal beds ; that at Cherra Poonjee, for instance, having been put down at as much as 17 feet by one officer. The results are given in section b, Plate II, shewing thus more clearly the succession of the beds and coal seams, which, good and bad, gave a total of 20 feet. The similarity of the upper fine beds was remarkable, as being very like those which were seen capping the Lúmdekorh Hill.

Leaving this section and continuing the march, we ascended along the face of the hill, the coal showing again on the path itself. On reaching the compact hard beds of sandstone (*vide* Section on Plate III.) the ascent ended, and the general level of the country dips away with the even slope of its dark brown weathered surface towards the south, and in many parts over several acres in extent is entirely bare, all earthy matter having been washed off it. A quarter of a mile further

the village of Maokerasi, inhabited by a people of the Langam tribe, is built on a low knoll, rising above the plateau on the edge of the steep scarp that marks the sudden commencement of the gorge we had just come up. No streams find their way over this northern cliff, and the slope of the strata being south, the water issues from below and must have gradually caused the cliff and gorge to eat back far from the valley of the Um Blay.

From Maokerasi towards Nongkulang, is at first seen the tabular sandstone, which dips at a low angle from the edge of the northern scarp (see Sec. A, Plate III,) up to the stream that flows along the base of the Nongkulang ridge. This sheet of rock is so hard, that denudation appears to have made little or no impress on it, and the streams which cross its surface have scarcely cut into it at all, in fact, in many instances they flow irregularly and widely over its surface. At half a mile further on we crossed the main stream flowing westward, full of *Melaniæ* and *Paludomi*; the forest commenced immediately on the left bank and, I found, with it we had suddenly entered upon limestone rocks full of *Nummulites*. This was rather a surprise, as I had not expected to find them on the northern face of this ridge.\*

We now began to ascend the Nongkulang hill through a very great thickness of the nummulitic limestone series, certainly 300 feet, if not more of it; this rock ended rather abruptly, and was succeeded by sandy ferruginous strata, some of the beds being very nodular, continuing to the crest of the ridge. Near the highest level of the limestone rocks occurred one very marked bed containing *Nummulites* (about five feet thick) of very large diameter and perfect form; the stratum was horizontal and curiously weathered by the action of damp and water. The upper sandstone series was found to be rich in fossils well preserved; there must be several beds of these parted by non-fossiliferous, light friable shales, and by less fossiliferous sandy beds. *Turritella*, *Neritina*, *Cyprea* and a *Trochus*, were common forms, besides a few *Echini* and numerous *Bivalves*. I made a good collection of these, a hazy day intervening when survey work was stopped; yet owing to

\* I may here add, for the information of shell collectors, that this spot is a most productive one. Landshells were most plentiful, and in great variety. I added a large number to my collection in a few minutes, many of which have since turned out to be new species. It was just their favorite spot, a dense damp forest, black vegetable mould and limestone rock,

the sandstone being so friable and soft, it was very difficult to obtain perfect specimens.

From the top of the ridge, looking north and west, the view was a curious one, and showed the geological features very strikingly. This was principally due to the hard sandstone of the Maokerasi plateau which, I believe, to be exactly the same as that on which the station of Cherra Poonjee is built, and it occurs precisely on the same horizon as regards the nummulitic limestone. I give a panoramic sketch, taken from Nongkulang, which will give, I trust, an idea of this portion of the Khasi Hills, with those of the Garow hills in the extreme distance. (See Plate IV.)\*

In such interminable forests, as here cover the country, it is not an easy task on first coming upon a new series of beds to make them out, and be quite certain of their relative position. I was inclined to think the fossils I had found, bore a cretaceous type, and again the perfect horizontality of the limestone did not appear conformable with the southerly inclination of the sandstone, which is about 5—7 degrees. We may account for this by the difference in their mode of deposit. The Molluscs in the upper beds point to a shallow sea with, in all probability, a sloping bottom. The limestone partakes in many places of a southerly incline, even very perceptible further west. To clear up this point, I made several excursions around this ridge, and was successful in finding several good sections. One of the best of these sections is to be seen on the path that leads from the old and deserted village of Nongkulang, to the new site of the same; it was at first a somewhat puzzling one. Leaving the trigonometrical station for some distance west, the main ridge on which it stands, is followed; it soon falls, the ferruginous sandy clays and shales continuing all the way to the first considerable ravine, and on the left bank of this, limestone comes suddenly in, but does not extend to the right bank. By following down this narrow ravine bed, the section d, represented on plate VI, with plan, in the nummulitic series was displayed. In this section *r* represents the hard white coloured limestone; *s*, where the path crossed the bed of the ravine, is a blue clay, four feet thick, resting

\* There is one error I must point out, *i. e.* the peak of Wanrhy is too far to the north, its true position is immediately over Pudengrú scarp. This mistake originated by my putting in Wanrhy from another sketch, the peak at the time having been obscured by haze.

on light blue limestone and containing small *Nummulites* ; its thickness is about 5 feet. This bed was succeeded in descending series, by 10 feet of sandy beds, *u*, the lowest being calcareous ; then followed a massive bed of dark blue clay, *w*, quite 35 feet thick, in parts very nodular ; these nodules were large and very hard, inside of a darker colour than the clay, and were not in the least calcareous. I found no fossil remains of any kind in this stratum. The lowest rock, *x*, seen at the junction with the last, and in the bed of a larger ravine with running water, shewed about 12 feet in the section. This limestone was full of large-sized *Nummulites*, and the base of the series was still many feet below. The hard blue clays were a new feature, as also the sandy beds ; both were only locally developed. On the ascent to Nongkulang, I did not see them nor again do they appear further west ; for proceeding towards new Nongkulang, the white hard nummulitic limestone is followed all the way from near section d, and is at last seen to rest on coarse and strong bedded sandstones, of the coal series (cretaceous?). Approaching the village, the path ascends a low spur, and with it the limestone, contrary to expectation, is left, and sandstone is seen. In a cliff section, bordering a clearing here, a good view of these lower thick-bedded sandstones is to be got, the limestone forming another low scarp ; on the south of the clearing scattered blocks of the same being still left on the intervening level ground. This marks the commencement of a great roll in the lower sandstones (coal series), its line of elevation running from east, and ascending to west, dipping low to north and south, taking the whole series some 1,000 feet in height up to the culminating cliff of Pundengroo. The amount of nummulitic limestone greatly decreases towards west ; the thickest section being that under Nongkulang hill series up to and as far as section d ; and I am even inclined to think that the beds were originally deposited on a very irregular surface of these underlying rocks. We cannot expect so sudden a change in their mineral composition to form a very conformable series.

To return to section A, the lower portion of which I have only alluded to. Following up the same ravine from the path, the highly fossiliferous sandstone of the Nongkulang hill series is seen on the left hand, or the east bank, and nummulitic limestone on the right or west. In the sandstone I found an *Ovula* with

*Echini*. Keeping to the well defined boundary of the limestone, I met with a well marked unconformity of the two series running in a line, from south-east to north-west, and at a short distance further on, from north to south. The limestone terminated in a perfect cliff, and not a single particle was to be found on the sandstone side of the depression between the two. In these depressions blocks of the sandstone were found resting on the limestone irregular surface, and the former also rose in a rounded hill considerably above the general level of the latter. I give a sketch, (Plate VII) and a section (Plate VIII) of this upper junction. The local unconformity of the rocks clearly shews, that the sandstones have been here deposited around and against an old cliff of the limestone rocks. The section exposed in the same ravine, showed it was no result of local displacement.

In some new clearings, close under the trigonometrical station of Nongkulang, and on the north side some good sections are to be seen of the relative positions of the limestone and superincumbent sand. The first and highest bed of the nummulitic limestone series, is a peculiar dark burnt, umber-coloured calcareous rock, containing scattered very small *Nummulites*. In a ravine close by the light-coloured pure limestone was seen to pass horizontally into the hill. Great hollows occurred in the surface, where the limestone had evidently fallen in, and the ravine first mentioned entered into one that was of great depth.

Proceeding from Nongkulang south along the path to Shibak, one passes over a steep scarp of some 50 feet in the upper sandstones (fossils numerous), which extend some distance to the bed of the first considerable ravine. Nummulitic limestone occurs here again, and following it up in the section represented on plate VIII, it is seen close to the path, being a hard blue clay (*w*); it contains hard nodules of the same material, its thickness varying from eight to ten feet. This accords, in its character, with Section d, see plate VI; above *r* is a great thickness of white pure nummulitic limestone, continuing up the face of the hill. Below the blue clay, following down the ravine, is a darkish purple earthy rock (three feet), it effervesces slightly with acid; then follows a bed of a dark brown rock, having minute white *Nummulites* scattered through the mass, and being interstratified with some light-coloured beds, the

whole thickness amounting to about ten feet. The darker coloured beds are seldom more than one foot thick, and the whole rests on a hard thick bedded and light-coloured limestone (*x*), the thickness of which is unknown, although it must be considerable.

In this section again, the unconformity of the upper sandstone is apparent, masses of it are seen resting on all the above beds, in the position of outliers, and are the remains of the upper series, deposited against a high and irregularly scarped surface of the limestone series. The dark umber coloured bed, with small *Nummulites*, corresponds to the one mentioned, as seen on the north side of the ridge, being the highest of the limestone resting on the sand, but I am much inclined to think, that on that side (the north) much of the limestone was denuded, prior to the deposition of the fossiliferous sandstones and shales.

After leaving this section, one passes (on ascending to the crest of the ridge to the west) on to coarse sandstone of the lower group, *infra-Nummulitic*. There is no doubt of this, as on the south-west face, after crossing the crest, these same rocks dip into the valley at an angle of 10 degrees S. W. One again encounters the nummulitic limestone near Purjonkha, clearing the strata, seen in a ravine close to the field and belonging to the lower sandstones, on which the limestone rests horizontally. From the sudden appearance of these lower beds on the above ridge, close to the strata showing no sign of bending or contortion, I am inclined to think that even between these two last, a considerable unconformity exists, and that separation can be established. The surface of the lower beds must have been locally altered in level, before the nummulitic limestone commenced to be formed. Throughout the great thickness of the lower sandstone with coal, I have never found a single Mollusc or any remains, save those of indistinct vegetable matter. According to the sections, noticed by Messrs. Oldham and Medlicott, we should find, as at Cherra, the cretaceous rocks here; whether these sands with coal are their equivalents, or whether they will be eventually found below, or above them, and adjacent to the nummulitic formation, is an interesting point, yet to be discovered;—the probability is, that they are upper cretaceous.

From Nongkulang, direct to Maokerasi, a good section, displaying

the conformity of the last named rocks, with the limestone, is met with. In the bed of the small stream with water, near where the paths to Maokerasi and old Nongkulang diverge, the sandstones are seen exposed; the limestone rests horizontally on it, and from this the path leads down the easy hill side, through a descending series of the limestone to the level of the main stream, in the valley, in which it terminates. The way in which the sandstone passed under the limestone was very striking, the former being the same kind of rock one had seen higher up on the Nongkulang main ridge, where there was apparent unconformity. At one spot where the main stream here entered the limestone rocks, for a short distance, the scenery was extraordinary, from the strange and grotesque way these had been eroded. No water was to be seen, as it soon disappeared among the blocks and masses of rocks that filled the bed. All the limestone was perfectly horizontal, the effects of denudation were most extraordinary and marvellous; huge masses formed columns and natural arches, or standing on three or four thin pedestals reared themselves amidst the forest trees, 15 to 20 feet in height. Sometimes such a mass was surmounted by a tall stately tree, whose roots ramified among the holes and crevices in the rock; huge cable-like creepers hung suspended from, or wound round them, while canes and ferns formed the under-wood, and flourished in the dark vegetable mould of this damp virgin forest.

After leaving New Nongkulang less limestone is encountered, though it occasionally is seen on the left hand side of the road, but is nowhere thick, and partakes more of the character of outliers that have stood out the forces of denudation. In all the numerous ravines that are crossed, up to the steep descent into the Riangwylam, the lower sandstone in thick beds is seen with a dip of from 10 to 12 degrees west, bending to south-west, in the direction of the main ridge. The descent into the Riangwylam valley was quite 300 feet; on reaching the river and looking up the gorge, a fine cascade is seen falling over a sheer cliff of horizontal strata, the limestone at the top; the whole scene being most lovely and grand. In the bed of this stream, lay masses of limestone fallen from the cliff above, and a few pieces of coal soon led to my finding a thin seam of bad quality, and evidently the highest in the series. It was about one foot thick associated with coarse

sandstone of light colour. A bed of carbonaceous shale above this contained a good deal of shining iron pyrites, and was very heavy. A steep ascent here commences, up a spur, bounded on the north by a lateral valley of the Riangwylam, we had just crossed. Beds now were seen, with the rise to have an easterly incline, or the commencement of another great roll in the sandstones. Near the top a trace of coal was found, but nowhere in the forest could I find a satisfactory section. The thick debris covered the ground too deeply, the associated beds being very fine sparkling, lilac coloured sandstones. At the top of the final ascent, where an open glade in the forest was entered, the surface sandstones were of a very gritty coarse description, with thin beds of water-worn quartz pebbles, and had more the look of the coarse beds seen near Maobelurkur, &c. After crossing a ravine where the dip is south, these beds are seen capped by the lowest strata of the nummulitic rocks, but it is a mere outlier and only some 20 feet thick. Several other isolated masses are contiguous. The sandstone, beyond this a short distance towards the village of Nongumlai, dip with the surface level of the ground, and is evidently of the same hard durable kind, that occurs near Nongkerasi, but here it is thrown up several hundred feet higher, falling towards the south-west to rise again in a higher roll, in the culminating scarp of Pundengroo.

The village of Nongumlai is a very good central point, whence the geology of this neighbourhood can be studied. It stands on an open bare slope of the hard sandstone that terminate a few hundred yards below, in the main stream, a source of the Um Durliang flowing to the south. Immediately beyond this stream a densely forest-clad hill rises rather abruptly, all of nummulitic limestone, the surface of the slope being as usual, most fantastically eaten away. Thence to the south a very large area covered with forest is also of this rock, in which all trace of drainage lines ceases, water finding its way down the innumerable crevices and holes, or rather wells in the rocks, for the word hole hardly expresses the deeply honey-combed state, it presents. Land shells literally strewed the ground, principally large *Cyclophoridae*. The limestone here presents a thickness of some 250 to 300 feet, and is very similar in structure, colour and hardness throughout, none of the blue and clayey bands being seen. Both in the stream and near the top of the ridges, transported small lumps of the fossiliferous

upper beds were found, but nowhere did I see it *in situ*. The large quantity in the ravine points to its existence higher up the valley, but I had no time to penetrate in that direction.

To give some slight idea of the majesty of these forests, I may here give the dimensions of a tree on the top of this hill on which a *maichan* was erected by one of my assistants, ascended by a rough ladder lashed on with cane. After sketching the surrounding country on the plane table from it, on descending, I measured it down 92 feet. The upper branches before they were cut away to open out the view were probably 20 feet higher. The tree was without a branch for 50 feet from the ground, a clean straight trunk, but at that height forked into two contiguous stems, and continued thus for 30 feet higher. Its girth was small for size, being only some 14 feet near the ground. This tree was a very good average, few were shorter, and many exceeded it. With such associates, those who have never seen such tropical scenery, can hardly realize its features, and the feeling instilled by the antiquity of such vast growths of vegetable life, when passing through them for hours of the day. In such a country all its topographical features are lost, and to see them and sketch them in, the only plan for the surveyor is to erect platforms on trees, selected for the purpose, that they overtop and command the sea of waving foliage that stretches for miles around. Reaching the level of such a platform and emerging from the gloom and shade of the 80 feet below one into bright sun, with the far horizon of blue hill and mountain, and nearer valleys, is like entering another world. The highest level of these forests form a densely populated zone of insect life, among which the *Lepidoptera* seem to rule, and many a coveted form have I seen from these sites, flitting safe beyond the reach of net, much less of foot.

One of the most conspicuous hills in the neighbourhood of Nongumlai is Yindku, and as on its flanks some of the best sections are to be obtained forming a passage into still newer strata, I will describe them as they come in in turn along the ridge. This has a direction almost due south, to which the road keeps. The sandstone on which the nummulitic rocks in their outliers are seen, extend for some distance, the dip about  $15^{\circ}$  east;  $1\frac{1}{2}$  miles from where this path leaves that from Nongkulang to Nongumlai, at the foot of a rather steep ascent the

limestone occurs in great thickness, the total being perhaps 250 feet. On this ascent I came on detached pieces of the fossiliferous iron-coloured clays. Next in order came the nodular ferruginous sandstones, noticed also below Nongkulang on the northern side, and then again some 40 feet of limestone. The topmost bed of this rock was of a brown umber colour, the *Nummulites* were small and much reduced in number, with here and there a faint trace of a shell; shales, and sandstones with precisely the same fossils as I had found on Nongkulang ridge, then succeeded. The base of Yindku was quite  $1\frac{1}{2}$  miles further along the ridge; where an ascending series of the beds is first noticed, they at once become much lighter in colour, and coarser in texture. With this change the fossils become scarce, at last only an occasional bivalve is to be found, and these soon disappear altogether, thin shaly beds intervene, and at the top of Yindku itself, the rock was soft, sandy, and friable. The thickness of these newer deposits is quite 200 feet, the dip now being very low to N.W. Yindku from its isolated position, and greater height than any of the hills around, formed an excellent point for observation, but being covered to the very top with large timber trees, would be of little use without a *maichan*. From the one built there, the view was most commanding, extending to the very foot of the hills in the Mymensing district.

On the spur thrown off from it, to the east, a like section to that first described, occurs again, and the best spot whence to visit it is Shibak, situated on the direct road from Nongumlai to Bagoli in the plains. After leaving the main ridge of Tigin near Nongumlai, a quarter of a mile of descent brings one to the Laokla stream flowing north. Leaving this a ridge of the fossiliferous beds is another stream, the Umperton, is crossed where they dip S. W. at a low angle; on the descent, the unconformity was again noticeable, although the beds still retained their normal horizontality. After descending over a considerable thickness of the nummulitic limestone, it suddenly is replaced by the ochre-coloured sandstones, at the foot of an ascent extending to a height, considerably above the lowest limestone just left. At half a mile, limestones again dip north  $5^{\circ}$ , and at the bottom of the valley all was of this formation; near a huge overhanging mass of it, used as a temporary shelter, it was seen to rest on a light coloured fine sandstone (the cretaceous?), the same sequence in every respect as is seen near

New-Nongkulang. The Shibak stream was now quite close, flowing over the slightly sloping surface of the lower sands, and striking the edges and the termination of the limestone, which also marked that of the forest. This valley of the Shibak was for a long time a very great puzzle. In no direction could I see any likely depression in the forest-clad heights about, where the united streams of Shibak (the Wakit from under and north of Yindku, and the Umpernon and others) might find their way to the plains.

The conspicuous cliff of Kúta Bram, was the only open point in the neighbourhood, and it was by visiting this, I determined the existence of a very anomalous physical feature, on a really grand scale and one which, though familiar with the like topographical feature on a small scale, as seen near Cherra Poonjee, fairly surprised me. The cause is simple enough, the united streams all meet in the nummulitic limestone, that here extends quite across the main valley; the streams drain away under it, over the surface of the harder sandstone on which it rests. This water must percolate under the Kúta Bram ridge into the Rugsir, but the greater quantity evidently finds its way into the Gabir, at Bagholi, there a large stream without an equivalent drainage area. The ascent to Kúta Bram cliff is through a forest of enormous trees in the bottom of the valley, passing into bamboo near the crest of the ridge, that rises quite 350 feet on the south. The fossiliferous sands succeeded limestone as usual, and continued to a short distance within a few feet of the cliff; this consisted of fine thin-bedded sands, micaceous, of light ochre and gray colours; they dip about  $10^{\circ}$  south, but no fossils could I find in any of the debris at its foot, although about 100 feet of the beds were here exposed. This newer series covers all the spurs south of Yindkú, and is exposed again on a direct path leading from that peak into the Rugsir and on to Gillagora, a village of Habi-ang Garos. Some of the beds at this point were of a blue, crumbly clay, and all thin-bedded; the presence of springs causing land-slips, have formed this bare open spot, whence a fine view is obtained.

Passing on down this ridge, nummulitic limestone again makes its appearance on the right hand or the west, rising in a very steep cliff, the path is over the red sandy clay (fossils being numerous of Nongkulang forms) at its base. Descended at last rapidly into the bed of Rungsir, here hard massive fine sandstones passed under the limestone, which

dipped far higher than yet seen in this area, being evidently on the south side of an anticlinal fold. The beds where first observed, dipped  $12^{\circ}$  south by west, then  $15^{\circ}$  to the south, increasing to  $20^{\circ}$  and  $25^{\circ}$  south. Although a deep gorge existed through the mass of the limestone (here very thickly bedded) no water is seen; at about 400 yards through the gorge, it terminated suddenly with its highest dip, succeeded immediately by highly fossiliferous beds, well developed under Rongsitilah, (the summit of which is of the higher series, of coarser sand and thin shales). In the first open clearing on the right bank I found my best specimens of fossils in a bed *in situ*, most of the Nongkulang forms turning up. These rich deposits of shells are immediately succeeded, as one travels down the bed of the Rugsir, by thin-bedded bluish clays, the sandstone shales becoming more sandy and compact, the dip increasing with every few 100 yards, until below the village at the debouchement of the stream into the plains, at the very last spur and section exposed, they are complete sandstones of very lower tertiary Siwalik type; their colour is brown, and their dip about 50 degrees to the south.

Emerging into the rice fields of the plains, and looking both to the east and west, it is very evident that the last and far newer beds, extend on both sides along the base of the hills. The dip of the beds is seen on the ridges of the spurs most markedly,—more marked is this on the west, at the base of the true Garo hills, and these, bending more to the south of the latitude, we are now standing on, bring in beds of again a later period. Save for the marshy plains, flat as an ocean and the greater exuberance of the forest on the hill slopes, one might be looking at an expanse of the Siwaliks of the Deyrah Dhoon, the same characteristic long slopes towards the plain terminating in a short steep fall on the north, whence rises another long slope of rather a less incline to the horizon.

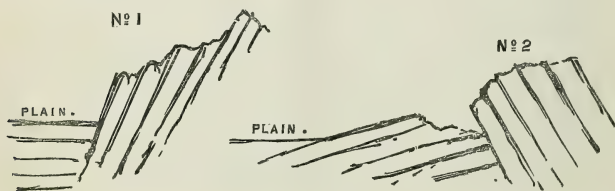
I followed the foot of the hills, in both directions; 1st, on the east side to Bogali, where two streams the Gabir and Ronga unite, and form a large and navigable stream. Nothing new is observable thus far, the different “soras” or streams take their rise in the tertiary sandstones; in their beds, the same succession is seen, as in the Rugsir at Gilla Gora, and the usual fossils are also found as one gets deeper into the series. Crossing the Gabir into the village of Bagoli,

the whole eastern side with the hill slopes, are of nummulitic limestone, which here abuts on the plains; the Ronga flows out through the mass of it, which dips  $25^{\circ}$  south, in hard thick beds, and is the first point on this side, where it is worked for the Calcutta lime trade. A limestone quarry, with a shallow canal approach for canoes, occurs about  $1\frac{1}{2}$  miles to the east of Bagoli, worked I believe by the Manager, C. K. Hudson, Esq. of the Inglis estates. The Ronga river takes its rise immediately under, and to the south of the Nongkúlang hill series, and has one point of interest, but I was unable, from want of leisure, to follow up and examine it. Much coal is to be seen in the bed of the stream brought down from above, and can be no other than an outcrop of that in the infra nummulitic beds seen and described at Nongkerasi; what its extent may be here in the Ronga, it is impossible to say, but it deserves examination. A subsequent attack of fever prevented my penetrating further to the east of this line, in the most interesting and promising part of this geological district, where the useful mineral beds approach so near the plains with the magnificent water carriage which the Um Blay must offer at this very point. I do not think it likely that the coal will be found again near the base of the hills, west of the Moishkulla or Rungsiang river, for a very considerable distance. The general strike has assumed too strong W. N. W. direction, towards the culminating point Wanrai, and the tertiary sandstones appear very persistent, and with greater breadth, west of Chanda Dinga, owing to the slight extension of the hills southward. Returning to Gilla Gora, I carried my survey along the base of the hills westward, crossing the Rongsiang, near longitude  $91^{\circ}$ , and on to Chanda Dinga, in order to ascend and observe angles at the fine elevated hill of Marang Thang.

All belongs to the older tertiary series here; the principal and most noticeable feature of the rock being, the great increase of dip in this direction, coming in with the newer beds of the series (this is shown in Section B, Plate III), until at Chanda Dinga, the beds are almost perpendicular into the plain, forming here a bare flat rock on the hill side, marked in the old revenue map, as Chanda Dinga stone. The beds here had assumed that coarse texture, with light brown, or gray tint, lithologically so exactly similar to rocks of the Siwaliks,—even to the scattered strings of water-worn small pebbles, met with in the

great mass of the lower series, known better as the Nahun group or Lower Siwalik formation,—that I think they can be well placed on that horizon. Whether this will be proved still further west, by the presence of the later Mammaliferous sands and gravels of the higher, and again unconformable series of the Siwalik group, is to be seen, and it is a most interesting point; or may not these last beds still exist under the present plain of Sylhet and Mymensing, undisturbed, abutting like the present land surface against the lower series? The change is so sudden here, from dry sandy steep slopes to swamps, that within a few paces of the hill side, the ground is covered with the dead shells of *Paludina* and *Ampullaria*; the sections seen in the beds of the streams show an alternation of sands with dark clay, containing the same shells. I could point out a bed, under and to the south of Nahun, so precisely similar, with the above shells (particularly the more lasting *opercula* of the latter species) that no one who had wandered over both areas, examining them attentively, could fail to be struck with the great similarity of their deposition. The only difference rests in the present unconformity of the one, due to elevation; and in the still normal position of the other, slowly accumulating bed over bed, and perhaps in some future geological age, to pass through the same mighty changes. Medlicott's explanatory ideal section in the Markunda under Nahun, (where also lies the beds I have just referred to) is nowhere brought so forcibly to the imagination, as at the foot of these Hahieng Garo Hills.

The beds are actually at Chanda Dinga so near the perpendicular, that a transition from No. 1 to No. 2 (*vide* Ideal Sections below) is easily wrought, and this is what is actually seen at the junction near Nahun, if anything greatly exaggerated in nature, from the lateral force that has been introduced.



After visiting Marang Thang, whence the deep gorges with precipitous sides of a large river, draining from south-west of Pundengroo scarp, was seen, and presenting a complete section of the whole series I have been detailing, I retraced my steps into the interior of the hills once more, *viâ* Júgni, situated about four miles up the Rongsiang river. I give the reader some idea of this mountain stream, its features being so unlike what is generally seen, and nothing like it is met with at the base of the Himalayas. I proceeded the whole way, without much obstruction, in a canoe to Júgni, the water being so little deep in parts that save to a native who easily disencumbers himself of superfluous clothing, it would have been a most disagreeable route. It became still more difficult to navigate beyond the above village, shallows and rapids commencing; yet very deep long reaches still continued right up to the junction with the Sen river, where is a pool famous for the immense number of fish killed periodically by poisoning the water. With a stream navigable so far into the hills, one would expect the valley on either side to be broad and somewhat open, the contrary is however the case. For the whole distance the spurs approach, and end in high sheer cliffs, washed by the excessively deep water of the pools at their base; opposite Júgni itself these cliffs are at least 200 feet high.\*

The whole valley is extremely malarious, close, and shut in from air, and we all suffered a few days after from passing up it; not a man with me or self escaped fever, the season was advancing, rain had begun to fall (March 1867), which may account in a measure for the suddenness of the attack. A short distance above the last deep pool, the river is seen gushing out, with a considerable body of water, from a small cavern in the limestone rocks. The valley still continues over these dipping at about  $20^{\circ}$  to  $25^{\circ}$  S. S. W., their strike being in the general direction of the valley. At about two miles further up the limestone comes to an end, and the lower sandstones become visible; they dip at 30 degrees. Pieces of coal had been common for some distance below, and here it was seen *in situ*, with an increasing

\* They present excellent sections of the sandstone rocks: these gradually lower in dip, becoming very low and rise again towards the junction with the Sen river. There is nothing remarkable in their appearance, being thick-bedded, sometimes very soft light coloured and micaceous; their dip is always a southerly one.

dip in the coarse sandstones. About 400 yards on was another bed, of greater thickness and better quality, the remnants of which we had seen scattered all the way down the stream bed ; it passed quite across it, from bank to bank. For a better idea of this most interesting section see that marked C ; it will be there seen, that the coal is brought to the surface by the anticlinal in the whole set of these beds, which extend to the nummulitic limestone, being evidently much disturbed here, and seen to change suddenly from a dip of 60 degrees N. E. to perfect horizontality, and continuing thus with the slightest dip, about equal to the fall of the valley, all the way up to Nongumlai. This line of dislocation, it will be seen from a glance at the map, is curiously situated, in a direct line, with another evident great bending of the same strata in the Rugsir, where the limestone crosses that stream, and would extend to Bagoli, where the limestone is again seen bending over with an increased dip of 25 degrees to the south. Continued to the N. W. as a due straight line, it passes through a culminating point of the Garo hills, Wanrai Prak, which seen from a distance is doubtless of the newer stratified rocks, having there attained considerable elevation.

Not far above the last mentioned section the Sú Hileng tributary comes down to the N. West ; and from under the eastern scarp of Pundengroo, much coal is washed down ; but I had no opportunity of visiting the site.\* To the north of Tigin hill-station the coal is seen, with a dip north of about 8 degrees and a thickness of some 8 to 10 feet, in the infra nummulitic beds ; this northerly dip brings in the limestone at the bottom of the valley, whence the beds rise again with a S. S. West incline, and a very low angle. At a distance of some six miles, the path descends into the Asbik river, close to which, the same coal is met with again, here almost in a horizontal position. It is again seen on the ascent of the left bank, but a good deal of it is covered up with debris. On descending to the Wy-yow river on the other side of the ridge, gneiss comes in, and I did not again observe any stratified rocks all the way to Nongtien Shiling, and thence *viâ* Nongkushba, until Landekar is again reached. The Um Blay at this part of its course, flowed through the mass of metamorphic rocks.

\* Native information indicates that the coal here is in large quantity ; even should this be found the case, it is too far into hills to be worked profitably.

From the preceding notes and sections, it will be observed, that on this longitude we have no infra-nummulitic coal as at Cherra, that the seams here occur always below the last named formation, at a very regular depth below it, and that unlike the coal of Cherra, it is very persistent over a large area, and often to be found in a series of deposits one above the other. It is to be traced along the high long line of bluff that bounds the Um Blay on the south, in its south-east course to its debouchement near Puna Tith bazar. If this coal ever be utilized, it must be somewhere in this neighbourhood, or between longitude  $91^{\circ} 10'$  and  $91^{\circ} 20'$ , and south of latitude  $25^{\circ} 26'$ . This small area would well deserve a close inspection, and the results would be extremely interesting, if continued to the east, the rocks be followed out into the Cherra sections. Until this be done, it would be premature to theorise, or draw comparisons, between different beds, one of which, the limestone, is identical, while the beds both immediately below and above differ very much. I have already stated my opinion that for a long distance, west of Chaudadinga, and the Rongsiang rivers, but little coal can be expected to be found, from the presence of tertiary sandstones on that side.

This paper has now reached a size I little contemplated, yet with its errors, with which no doubt it may abound, in bringing it to a close, I trust it may prove useful to those, who may at some future date visit, and plot out the same sections.

*Camp, Cherra Poonjee, October, 1867.*

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ON THE ANATOMY OF *SAGARTIA SCHILLERIANA* and *MEMBRANIPORA BENGALENSIS*, a new Coral and a Bryozoon living in brackish water at Port Canning;—by FERD. STOLICZKA, Esq. Ph. D., F. G. S. Palæontologist of the Geol. Survey of India.

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Special interest is always attached to the study of any organic forms, found living under unusual and sometimes anomalous conditions, inasmuch as these forms very often represent peculiar types of organisation, adapted to the peculiar circumstances under which they live.

In a theoretical point of view, there exist, we may say, in *each specific* organism a number of forces which, by their harmonious action, produce a certain stable equilibrium between the organisation of the animal, and the influences of the medium in which it lives. Should it now happen that the animal is, either voluntarily or accidentally, placed, under conditions *different* from those under which it formerly existed, and further, should the influence of these external agencies be so great as to overthrow, or be not sufficient to maintain this equilibrium, it devolves upon the organism to restore this balance, or to be dissolved into various other forces. The latter case need not occupy here our attention any further; but as to the former, we may observe in general that the amount of the changes in the organism, necessitated for the purpose of restoring the disturbed or unstable equilibrium, may in various cases be very different.

In some cases an alteration in the colour or in the viscosity of the animal may suffice; in others it requires a change in the digestive or the nervous system, and again in others it becomes necessary to change the existing, or to produce new and additional organs of locomotion, &c. Thus are clearly by *natural selection* produced new forms or types of organisms, designated by naturalist *varieties*, *species*, *genera*, &c.

Looking at the same time upon the numerously varied organisation of beings in general, it will readily be understood that the less different the organs of a species may be,—that is in other words, the lower its place is in the natural system,—in the same degree would probably decrease the necessit for a change in the organs. In any case,

this change would not be so easily perceptible, as when the organs are numerous, various and more highly developed. Expressing, therefore, this idea in a more general way, we imply that, within certain limits,\* forms of lower organisation possess a greater faculty of accommodating themselves to different conditions of life, than more highly organized beings.

In the present communication I shall record a very interesting case of the persistency of a form under different conditions, relating to a coralline species, a so-called sea-anemone, and to another species belonging to the Bryozoa, or the lowest organized Molluscs. With respect to the anatomy and physiology of these two species, I shall state all the data which I have obtained, for though some of them are not directly new discoveries, still detailed records of these animals are so rare, that I must treat the subject somewhat at length, in order to be intelligible; and this, I think, is very necessary as naturalists have become in late years rather sceptical regarding new species, only characterised by few high sounding,—occasionally unintelligible,—terms. Besides this, it would be impossible for me to give additional observations, without bringing them into a systematic connection with those which are already known on this subject.

*Phylum, CÆLENTERATA.†*

(Cnidozoa or Actinozoa.)

The name *Cnidozoa* is derived from the word *αἱ κνίδαι*, used by Aristotles for the designation of this group of animals; the same word is now retained for the name of special, defensive cells which characterize these animals, as will be shown subsequently. For the extent of the various divisions of the CÆLENTERATA, Leukart and Kölliker's works have to be consulted.

\* It is very often stated that the more highly organized forms possess a greater faculty of accommodation; this is, however, I think, a mistaken idea, originating partly in the comparison of the same external influences upon organisms of different kind and degree, partly in the difficulty of noticing any changes in the lower organisms. The comparison must always be a truly relative one; for in differently organized forms, there is a different amount of forces present to counteract the influence of external agencies.

† The first few principal divisions are noticed according to Hæckel's *Generale Morphologie*, 1866, vol. II. p. L.

*Sub-phylum*, PETRACALEPHÆ.\*

(Polypi).

*Class*, ANTHOZOA.

(Zoophyta.†)

Body fleshy, attached with one end; on the other provided with a mouth usually surrounded by hollow and perforated tentacles; internal cavity divided by septa.

*Sub-class*, HEXACORALLIA.

The original number of septa and tentacles are *six*.

*Order*, HALIRHODA.‡

(Zoantheria malacodermata, sea-roses, sea-flowers, or sea-anemones.)

Body soft, septa not forming an external hard skeleton, into which the animal can retract.

*Sub-order*, ACTINIACEA.

Body very rarely containing loose, scleroid particles; base adherent at pleasure, not adapted to form a swimming sac; internal cavity instructed with very long, not emissible thread-like organs (*craspeda*),§ containing the so called nettle-cells, or *cnidæ*.

*Family*, SAGARTIIDÆ.||

Body pierced with loop-holes (*cinclides*) for the purpose of emitting long, retractile threads (*acontia*) containing *cnidæ*, being the defensive organs of the animal.

This family may be separated into two divisions, the *Sagartiinæ* and the *Bunodinæ*, the latter of which have the column instructed with tubercles.

\* From being usually adherent to rocks, the other sub-phylum is called *Nectacalephæ*, including the swimming or oceanic forms.

† This name is inconsistent with the usual nomenclature, and could only be used by reversing it into *Phytozoa*, but to this the name *Anthozoa* is preferable.

‡ This name only can imply that the animals live in water, which contains a proportion of salt, &c. it must not be understood as pure sea-water, for there are numerous brackish species belonging to this order.

§ To avoid numerous repetitions, I must direct any one, not acquainted with the terminology of the anatomy of corals, and especially of that of the HALIRHODA, to the subsequent detailed description of the various organs. Most of the terms will be found fully explained in Gosse's admirable History of British Sea-anemones. London, 1866.

|| The true *Actiniidæ*, and several other allied families, do not possess emissible threads, or *acontia*, and are therefore destitute of loop-holes, or *cinclides*.

## Sub-family, SAGARTIINÆ.

(Sagartiadæ, Gosse.)

The body is, according to Gosse, generally remarkably soft, more or less pulpy, lubricated on the surface with copious mucus, exteriorly mostly studded with *sucking cavities*, which, by forming a vacuum have the power of adhering to foreign bodies, but the margins of these cavities *do not rise into conspicuous warts*; the base is usually broad, the column moderately high, furrowed longitudinally; the tentacles are smooth, simple, generally arranged in uninterrupted circles at the margin of the disk; the *cnidæ* of the tissue are usually of the stilet kind, being long cells, with a short in itself retractile flagellum, called by Gosse the *ecthoræum*.

Gosse distinguishes the following divisions, from the relation of which the generic classification of our species will become apparent.

A; Tentacles moderately long, slender,

a; disk perfectly retractile,

a; column soft, destitute of suckers ... *Actinoloba*,

β;     "     "     with suckers ..... *Sagartia*,

γ;     "     partly provided with a rough

epidermis .... . *Phellia*

b; disk imperfectly retractile, . *Adamsia et Gregoria*

B; Tentacles represented by mere warts .. *Discosoma*.

Genus, *Sagartia*, Gosse, 1855.

All the species of *Sagartia* are characterized by a thick, fleshy, contractile body, adherent by a *base* which is under ordinary circumstances *wider than the height of the column*; the surface is studded with numerous small suckers, not forming permanent warts, and with many comparatively large *cinclides*; the peripheral margin of the disk is distinct, *but not separately thickened*; the tentacles are simple, placed near the outer periphery of the disk; they are generally very numerous, but variable in length and arrangement; the mouth is somewhat elevated, provided with two *gonidial* grooves, each having a pair of tubercles on either side; the *acontia* are numerous, and are emitted freely.

The *presence of solid scleroid particles* of two kinds, as they will be described in the present species, may likely be added to the generic characters of this genus, but this has to be proved by the examination of other species.

*Species.* *Sagartia Schilleriana*, *Stoliczka*, 1868.

Plates X and XI.

Char. *Sagartia corpore pulposo, transparente, virescente pallido, basi lata, sæpissime rotundata adherente; columna cylindræa, in altitudine diametro basis fere æquante, longitudinaliter angustatim sulcata, transversaliter minutissime corrugata; septis ad peripheriam plerumque 48, distinctis, æquidistantibus, alternatim virescentibus; tentaculis numerosis, prope peripheriam disci sitis, exterioribus brevissimis, interioribus gradatim longioribus, omninis ad basin inflatis, versus apicem attenuatis, terminationibus subtruncatis et perforatis instructis; tentaculis seriem primam formantibus senis ceteris conspicue crassioribus, ad basin sæpissime rubescentibus, ad terminationes albidis; apertura transversaliter ovata, angusta; labio plus minusve prominente, ad marginem undulato, sub-reflexo, tuberculis duodenis instructo; lenticinibus bipartitis, ad utrumque angulum gonidiales sitis, tuberculis ceteris minoribus; canalibus gonidialibus parvis, orificiis rotundatis, vix prominulis, albide marginatis notatis; radiis gonidialibus vix dignoscendis; gula sulcis virescentibus furcata.*

*Ovariis duodenis, bipartitis, folliculis in utroque latere septorum sitis, cæruleo-purpureiscentibus; craspedis numerosis, sordide luteolis, interne suprâ ovaria suspensis; acontiis albis, perlongis; cinclidibus subrotundatis, numerosis, paululum impressis, in tegumine irregulariter dispersis, nonnullis prope marginem superiorem columnæ positis latis-simis, semper apertis, ceteris minoribus aliquantisper obscuris; cnidis ovato-elongatis, stiliformibus,\* ecthoræis brevibus prope rectis instructis; septis mesenterialibus intus ad basin solidulis, albis; tegumine corporibus minutis tabulatis siliceis, ac alteris subcylindræis et varie dentatis calcareis instructis.*

\* Gosse in his above quoted Treatise on the British Sea-Anemones distinguishes four kinds of *cnidæ*, all of which have rather long, spirally coiled *ecthoræa*, except one globular kind, in which no *ecthoræum* was observable. The *cnidæ* of the present species of *Sagartia* are mostly, short, straight, or very rarely slightly bent. I shall term this kind of *cnidæ* which were also observed formerly by Blainville, Leukart, and others, *stiliform*. Gosse says that the chambered form is the usual one in the *Actiniidæ*, though the present variation seems quite as common.

The principal and characteristic distinctions of this species are, the very great softness and transparency of the body, having a very slight greenish tinge, mingled with somewhat of a pale fleshy colour, a distinct layer of a dark green pigment being deposited near the external surface, below the outer muscular layer of each alternate septum, and thus producing greenish, longitudinal bands of about equal width; further, the prominent lips of the aperture, the great thickness of the primary tentacles, the blueish purple colouring of the ovaria, the yellowish craspeda, the purely white acontia, and their great length.

I shall at first speak of the various normal *forms* of this species, than of the *anatomy of the different organs* and of their signification, and last of the *physiology, the habits and modes of life*.

#### a. *Form.*

The general form of the body of *Sag. Schilleriana* is common to that of other truly marine species of the same genus, the column being, however, when the animal is expanded in a normal condition, a little shorter than the diameter of the basis (see pl. X. fig. 1). In consequence of the softness of the fleshy substance, the base, (which is comparatively more solid than any other part), always adapts itself entirely to the object on which the animal is sessile. On a smooth surface, the circumference of the base is almost circular, only on account of the projecting septa slightly undulating at the margin; on a rough surface all cavities\* are filled up with the fleshy mass, securing at the same time the attachment of the body, but also altering the original roundish form into an oval or irregularly polygonal one. The septa are distinctly traceable by the alternate greenish bands.

There are three principal forms to be observed, which may be called the *normal* ones, being successively adopted by every animal in a healthy condition. The first is the expanded form (pl. X. fig. 1) from which these animals derived their name of *sea-flowers*. The frequent bright colouring of the disc, as a rule, increases their resemblance to

\* I have seen portions of the body filling such cavities of about half an inch in depth, and one-fifth of an inch broad. When the animal was carefully detached, it lasted for several days, till all the protuberances disappeared, but they were at last assimilated to the regular form of the body.

an open flower of one of the *Compositæ*. The tentacles reach far beyond the diameter of the column, of which only the lower portion is visible; the body is perfectly transparent, allowing all the internal organs to be traced without difficulty, the lips of the mouth are slightly prominent; the water is seen moving up and down in the hollow tentacles, which play about actively in all directions, being strongly inflated at their roots, and gradually becoming thinner towards their tips.

None of the *Actinozoa* possess special organs of sensation, though they are highly sensitive to the touch of any solid body, and even to the influence of radiating heat, or to the light. The fact is that their entire body, when soft, and not covered by a thickened epidermis, is almost throughout equally sensitive and, therefore, makes special organs of sensation superfluous. Still, I should think, there must be an intimate connection of some kind of nervous system through the entire organism, inasmuch as the slightest touch of the tip of a tentacle is sometimes momentarily communicated to the whole body, its effect being exhibited by a change of the whole form of the body.

Thus a slight unusual movement of the surrounding water, or the coming into contact with a solid object, causes the *Sagartia*, when expanded partially, to contract, by which a quantity of the water contained, is always ejected through the existing openings, (*cinclides*). In this position, (pl. X. fig. 3) the animal forms a short column, with the upper margin [of which I shall speak as the *collar*] somewhat thickened, the aperture hidden, and the tentacles protruding about one-fourth of their length; the transparency of the body slightly diminishes; a few *acotia* are usually seen to rise from the central portion of the base, being then forcibly ejected through the *cinclides*, at or near the *collar*. Sometimes the tentacles are laid down, very slightly protruding, forming a sort of a broad cone; and then viewed from above, they are seen arranged most regularly: those, belonging to the different circles, being easily traceable from their thickness, (see pl. X. fig. 2). Any further disturbance generally induces the *Sagartia* entirely to contract, its form resembling in this position a short, depressed conical heap, (see pl. X. fig. 4), leaving only a small opening in the upper centre, from which usually the white tips of the primary tentacles slightly project. In consequence of the contraction of the outer muscular layer, -chiefly consisting

of concentric fibres, - the transverse plication becomes somewhat more distinct than it was before, and the immediate neighbourhood of the suckers slightly rises to short, transverse prominences. The greater contraction of the pigment layer also makes the greenish bands of the septa more distinct, though the entire body possesses a slight tinge of the same colour. The *cinclides*, especially those placed near or on the collar, become rather widely open, and others are distinctly traceable; the *acontia* are numerously ejected on different places of the body, and the general transparency has again diminished as compared with the former position.

Besides these three, so called normal, positions\* of a *Sagartia*, there are others which the animal assumes under certain abnormal conditions, generally resulting from ill health, and being produced, either by excessive heat or light, or by a change in the saline constituents of the water, &c. Some of the principal forms, as observed on one and the same specimen, are represented in figures 6 to 9, on plate X; but I will defer the remarks upon these, until I come to speak of the physiology and the habits of the animal.

#### b. *Anatomical Structure.*

In order more easily to understand the general anatomical structure of the animal, I must direct the reader to the vertical section, as represented in figure 3 on plate XI. This section is taken only in half of the diametral length, being sufficient for our purposes, and the different letters, noted in this figure, have the following significations:—a, base; b, column; c, collar; d, disc; e, tentacles; g, throat; h, larynx; i, stomach, or internal cavity; k, *craspeda*; l, *acontia*; m, ovaria, or the reproductive organs; n, *cinclides*, or pores in the integument for the purpose of emitting the *acontia*. I shall now briefly describe these parts as much as possible in the same order, in which I have just mentioned them.

The entire body of the *Sagartia* is surrounded by an external, mucous layer, which chiefly consists of numerous, oval *cnidæ*, and sparingly dispersed green pigment cells.

a. The base is, as already stated, a more or less round disk; on which the septa are distinctly traceable (pl. X. fig. 5), being of con-

\* Being observable in most other HALIRHODA.

siderable thickness, according to the different series to which they belong. The twelve ovarian strings, or reproductive organs, can be seen through the transparent skin; and equally easily traceable are the six bundles of the craspeda, in position nearer to the centre of the axial cavity than are the former.

b. The column represents the peripheral portions of the mesenterial folds, grown together, and it will, therefore, be sufficient to give a detailed statement of the structure of one of the septa. The original number of these, as represented in the view of the basis (pl. X. fig. 5), is six, radiating from the centre. The second circle is again six, the third, fourth, and fifth are each twelve, one septum first appearing next adjoining the primary septa, then one next to the secondary ones, than again one between the two last ones. This is a common law in all *HEXACORALLIA*, and I only notice it here, because I will subsequently draw the attention to the difference, apparently existing between the increase of the septa and that of the tentacles. The septa of the first, and usually also of the second, circle are distinctly traceable almost up to the centre, those of the 3rd and 4th nearly so, both being about equal in strength, but those of the 5th are considerably shorter. I have not observed in any of the numerous specimens which I have examined, a larger number of circles than five, or 48 septa altogether; small specimens often had only three or four circles developed. The various circles are schematically represented in figure 2 of plate XI.

Each septum is composed of five distinct layers, as represented in the enlarged section, plate XI, figure 3—*a*  $\beta$ ,  $\gamma$ ,  $\delta$ ,  $\epsilon$ . The outermost *a* is, as formerly noticed, almost only a mucous fluid, composed of a loose cellular substance, and a very large number of elongated nettle cells, or *cnidæ*, and a few dispersed cells of greenish pigment. The *cnidæ* of this mucous layer are, compared with others, the shortest, being ovately elongated, slightly curved or kidney-shaped, having, as a rule, an ecthoræum, shorter than their own length; they also appear to be nearly smooth.—Figure 4 of plate XI represents the appearance of the mucous layer under the microscope, and 4*a* three-isolated *cnidæ* still more enlarged.—The next layer ( $\beta$ ) is strongly muscular, chiefly consisting of concentric or cross fibres, forming at intervals slightly elevated ridges which

contain the so-called suckers; these becoming more distinctly apparent in the contracted position of the animal, (see fig. 4, pl. X). These suckers, however, are not essentially characteristic, and appear to vary greatly with the age. Along the dorsal edges of the septa, there seem to be also some longitudinal fibres present. This second layer is the same which, in several ACTINIACEA, becomes *coriaceous*, taking a principal part in the formation of the *exotheca* of other corals. The third layer ( $\gamma$ ) only consists of thick, transverse fibres, containing large, dark green pigment cells. Below this follows a tough muscular tissue ( $\delta$ ) consisting of thin longitudinal and much stronger concentric fibres, gradually passing into a regular cartilagenous skeleton ( $\epsilon$ ), composed of an intercellular substance, and a large number of various scleroid particles; the figures 5, 5a, 5b and 5c, on plate XI will illustrate this. Figure 5 represents a small portion of the fourth layer, the three upper ones having previously been removed by maceration. The muscular fibres are especially strong on a portion of the septum; the cinclides are spacious. Fig. 5a represents the reverse or internal side of the same portion of the integument, and shews on the surface an irregular distribution of the scleroids.

The two last layers ( $\delta$  and  $\epsilon$ ) chiefly compose the mesenterial septa, extending above to the mouth and at the base up to the centre, but being on the internal edge along the central axial cavity deeply insinuated. The hardest portions of the septa are those round the larynx and at the base, evidently on the two places where the strongest muscular actions are required. In figure 3, pl. XI the most cartilaginous portions are indicated by cross lines.

It is usually stated that the HALIRHODA, and especially the ACTINIACEA have neither an internal, nor an external solid skeleton, and this notion gave rise to the name *Hexacorallia malacodermata*. There can be, however, no doubt that in the present case the two internal layers, as represented on plate XI, figures 3 and 5, correspond to those which in the ASTRÆACEA for instance secrete the entotheca. The scleroid particles are of two kinds; some of them are long, with slight lateral appendages, and others simple, sharply angular flat bodies, as shewn in figures 5b and 5c on plate XI. These scleroid particles are only visible when enlarged to about 500 diameters; and some of them are still extremely

minute. In the fourth muscular layer, which chiefly consists of cross fibres, there are at distances small round holes to be observed, which evidently lead to the cinclides of the outer integument; these holes are often rather indistinctly traceable in the scleroid parenchym.

My observation as to the presence of solid scleroid particles in the internal tissue of the *Sagartia* has, in the first instance, been made in consequence of a simple process of maceration in water, and weak acid. It became, however, important to test further the true nature of these different scleroids. I consequently exposed a specimen, placed in a platina crucible, to a heat sufficient to remove every trace of organic matter, and was satisfied to find in it the residue of a perfect, solid skeleton of the *Sagartia*, on which were seen externally the holes for the cinclides, and, in being broken up, internally the septa. The external portions appeared more fibrous, the internal more broadly cellular or reticular. The character of the substance perfectly resembled the spongy and irregularly cellular structure of the corallum of other reef-forming *Anthozoa* (see fig. 6, plate XI). A portion of this skeleton was then placed in hydrochloric acid; this operation shewing that the solid skeleton mostly consisted of carbonate of lime, which is present in the form of the long scleroids (pl. XI. fig. 5*b*); the flat angular particles, being of silica, remained unaltered (fig. 5*c*). The latter formed a dark, very thin, irregular network, though most of them were loose, and apparently irregularly distributed among the calcareous scleroids. Besides the two kinds of scleroids, I observed a large number of extremely fine, often branching threads; but whether these belong to the tissue of the coral, or to some species of *sponges*, I was unable to ascertain. The proportion of siliceous scleroids to those consisting of lime is not probably more than one to twenty.

This direct proof of the secretion of solid scleroid particles in the internal tissue of the *Sagartia* is very important, inasmuch as it will in time, when more observations of this kind have been made, necessitate a change in the characteristics of the so-called *Anthozoa malacodermata*. It would be premature and unjustifiable to state that all the *Sagartiidae*, or other ACTINIACEA, possess an internal skeleton, as no other observations have been yet made on this point. It is, however, to be hoped that the present statement will induce stricter and more accurate inquiry, especially as Mil. Edward, Blainville, and others, many

years ago directed attention to the existence of those solid bodies in the internal tissue of some of the species of *Zoanthus*, *Actinaria*, and others. In spite of the solid skeleton which I have described, I must, however, remark that the softness of the body is unusually great in the present species, and nobody in observing the pulpy appearance of the same would suspect solid scleroids in it.

c. The *collar*, or the upper margin of the column, is generally slightly marked, though always indicated by a slight contraction below the upper edge. In the abnormal positions of the species, it becomes occasionally much more prominent, (see figs. 6, 7, 8, and 9 in pl. X); the muscular tissue is also much stronger on it, than on the other parts of the column, and sometimes nearly hardend. The cinclides on the collar are generally the largest, often forming a continuous series at its outer edge, while other loop-holes are irregularly dispersed over the entire column.

d. The *disc*, forming the upper part of the body, is very soft and transparent; it is only marked by radiating furrows which, strictly speaking, are in the present case an essential part of the tentacles. It probably consists like these only of four layers, the innermost, containing the scleroids, being wanting, or at least so much reduced, as to be hardly traceable.

e. The *tentacles* partially originate, according to the above statement, at the mouth, becoming isolated some distance from it; towards the periphery they are separated from the collar by a broad groove.

In the expanded animal, they are roundish, or slightly compressed from front to back, strongly inflated in the middle and at their roots, becoming after the first half length rapidly thinner. Their tips are slightly swollen or obtuse, and perforated. Externally the surface of the tentacles is smooth; but under the glass fine whitish spots, indicating the presence of *cnidæ*, may be observed (pl. X. fig. 1a). In the primary tentacles of older specimens the whitish specks are visible to the naked eye (see pl. X, fig. 1b). The anatomical structure (see pl. X, fig. 1d) of each of the tentacles is similar to that of the septa, except that they appear to want the scleroid layer. They are enveloped in a soft and usually very thick, mucous outer layer, being a little more consistent only at their bases. The *cnidæ*

of the outer layer are of the same shape as those of the column, but slightly longer; the ecthoræum being about the same length as the cell, or a little shorter and distinctly turned inside; the largest *cnidæ* are not more than  $\frac{1}{800}$ th of an inch in length (pl. XI, fig. 7).

Below the mucous layer, there is a thin muscular, then a pigment, and below this again a muscular layer (pl. X, fig. 1*d*). When the tentacles shrink in a sickly or a dead specimen, they have the appearance of thin, undulating threads, with a dark green centre, surrounded by a transparent viscous layer; the former representing the three inner, the latter the mucous layer, with a large number of *cnidæ*, (pl. XI, fig. 1*a*).

In a full grown specimen there can usually be counted about 160 tentacles, sometimes more; but I have not been able to trace in a perpendicular section more than five series of them. To illustrate the difference in the increase of the septa, and in that of the tentacles, as I presume it to be the case, I must direct attention to pl. XI, fig. 2, in which, on the right half, the disposition of the former, on the left that of the latter is shewn. The six primary septa meet, as I have formerly stated, in the centre of the base, but are not traceable on the disc. The six primary tentacles are seen to originate from each two tubercles of the lip, they are distinguished from others by their great thickness, though in length usually exceeded by the secondary ones. In the healthy animal they often are of a light fleshy colour, especially at their bases, and snow-white towards the tips; they are carried in a simple outward curve, generally with their tips, leisurely moving about between the other tentacles, which are more actively employed, as already stated. Observed with a moderately magnifying glass, the greenish and reddish pigment cells can easily be traced out. The white tint of the tips is, I believe, only due to a very large accumulation of *cnidæ*, which appear to be arranged in spiral rows, and become very distinct, when their inter-cellular substance is removed by its more rapid decomposition. On pl. X, fig. 1*c*, a representation is given of the tip of a primary tentacle, largely magnified. The *cnidæ* of this portion of the tentacles differ little in form from others of the integument, except in their larger size, having at the same time a proportionately thicker ecthoræum. Their fluid contents is homogeneous, perfectly transparent, and the cell-membrane is rather more tough, than in other *cnidæ*.

In very young specimens, the white tips at first appear on the

three alternate primaries, subsequently and gradually on all six. In very old specimens, the tips of the next, and even partially of the third series, become white. Wherever there is a large accumulation of *cnidæ* on the column, or where the *cnidæ* are of a larger size, the white specks in the integument are readily recognised, even with the naked eye.

To return to our former statement regarding the position of the tentacles; the next, or second series of them, consists of twelve,\* being distinctly traceable by a bipartition of the primary tentacles, with which they are connected on one side, while on the other, they extend to the lip. Thus, in position, the secondary tentacles originate more peripherically, and in pairs alternate with the primary ones; they often are the longest of all, being in large specimens about  $1\frac{3}{4}$ —2 inches in length, and most of them indicate by their whitish tips the presence of numerous *cnidæ*. This statement, relative to the position of the two first series of tentacles, is in the present species, based upon direct observation, but it was impossible to do the same with the other series; though in the next at least, or the third circle, a more or less regular bi-division partially appeared observable. Sometimes I could notice three tentacles of a next series springing up from one of the former series; but this certainly is not the rule. Moreover, judging from the total number of the tentacles, which appears to be rather constant in specimens of equal size, and allowing for accidental irregularities, we cannot be far from the truth, when we also accept a regular bipartition for the third and fourth series, as partially represented in fig. 2 of pl. XI. By this bi-division we obtain very closely the total number observed in live specimens, being about 160. In the specimen figured on pl. X, the tentacles of the first series had a length of  $1\frac{1}{4}$  inches, those of the second  $1\frac{3}{4}$ , of the third  $1\frac{1}{4}$ , of the fourth  $\frac{3}{4}$ , and of the fifth  $\frac{1}{2}$  of an inch.

f. The *mouth* is a transversally oval, or more or less linear opening, surrounded by prominent lips, which consist of twelve, elongated, inflated tubercles, between each pair of which originates one primary tentacle. On the two opposite ends of the longitudinal axis, terminate the *gonidial canals* with small roundish openings, (see *c*

\* The second series of the septa is only six, like the first; thus tentacles and septa do not, as already stated, take equal steps in their development.

in fig. 2, pl. XI). The functions of these internal canals have not as yet been traced out; I even failed to observe their extensions into the internal space. *Gosse*, and others, suppose that the eggs and spermatozoa are ejected through them, though I usually observed these conveyed through the mouth. The tubercles placed on either side of the gonidial canals, have been called *lentigines*, they are smaller than the others, and bipartite, (see *l* in fig. 2 of pl. XI). There also often extends a groove from the gonidial canal towards the periphery, which has been termed *gonidial radius*, but this is hardly traceable in our species. The greenish or pale fleshy colours are occasionally very distinct on the lips, and the internal muscular tissue of the latter is stronger, than that of the disk and of the tentacles.

g. The *throat* is the immediate continuation of the lips into the interior; it is longitudinally sulcated, the furrows being marked by greenish lines, produced by the contraction of the pigment layer. The length of the throat from the lip to the *larynx*, is about half an inch; towards the base it is slightly enlarged, and then forms a strong projection (the *larynx*) into the inner space.

h. All along the throat the inner muscular layer, with the scleroids, is rather consistent, and especially so at the *larynx*, where it is very tough and nearly cartilaginous, often more so than at the bases of the septa themselves. This muscular strength of the lips, of the throat, and especially of the *larynx*, is of course indispensable for the existence of the animal, being not only required for the seizure of the prey, intended for food in the stomach, but also for its retention.

i. The *stomach*, the internal axial cavity, is produced by an insinuation of the inner margins of the septa, these projecting to a greater or lesser extent into its space. The stomach extends from the *larynx*, which guards its entrance, to the base of the column. When the animal is expanded, the height of the stomach measures about  $\frac{2}{3}$  of the total height of the column. *Gosse* states that in some species, he observed internally on the septa thin, coloured layers, and is inclined to explain them as a sort of a substitute for the liver. Nothing of these layers was observable in any of the specimens of the present species examined. The stomachial cavity is the receptaculum of the food, and contains besides several other organs which are placed peripherically.

k. On the internal side of the larynx, and next to the entrance of the stomach, are suspended the mesenterial-threads, or *craspeda*. These are, in the present species, flat bands of one, or one and a half inch in length, being of a pale greyish yellow colour, and with the lateral margins partially rolled in, so as to have the appearance of nearly cylindrical tubes. They hang down loosely, and the greater portion of them lies in small heaps round the centre of the base. Their more central position as regards the reproductive organs, is clearly visible in the view of the base, (pl. X, fig. 5). There are always numerous threads together, but they cannot be easily distinguished through the integument of the base.

In figure 1, pl. XI, is given a representation of a specimen, which had itself turned inside out. In the centre the thickness of the primary *mesenterial* septa is clearly traceable, then the pairs of the ovaria, partly attached to the septa, and beyond those towards the periphery, the very numerous *craspeda*, and then follow the *tentacles*, with their shrunken tips;—two of the threads extending beyond the periphery representing the *acontia*. The *craspeda* are seen constantly winding up and down, like worms, contracting and expanding, and thus shewing great vitality, but I have not observed in them any rapid motions; they are never ejected through the cinclides. Examined under the microscope (see figs. 8 and 8a, pl. XI) their *cnidæ* are seen to be arranged in two marginal rows, lying with their longer diameter perpendicularly to the length of the craspedum, and leaving in the middle a sort of a canal or a string, which is filled with a cellular substance and a very large number of pigment cells; no larger *cnidæ* being visible in the centre. The cellular substance probably assists in effecting the muscular motions. The *cnidæ* are distinguished by a considerable length, (the longest about  $\frac{1}{500}$ th of an inch), being rather straight, generally attenuated at one end, and usually shewing in a slight curve an indistinct central line, indicating a moderately long but very thin ecthoræum; this latter is rarely seen ejected, but if it is it appears to be about one-third longer than the nettle-cell itself. The thinner ends of the *cnidæ* slightly project on the lateral marginal surface of the craspedal bands, giving them a very fine ciliated appearance. Numerous pigment cells and others are also observable between the marginal *cnidæ*.

The true nature of the *craspeda* in the physiological economy

of the animal is not known, and various suggestions have been made as to their signification. It appears to me that most probably they represent some organs of secretion. It is, however, likely that they also serve other purposes at the same time. I shall subsequently relate a case which tends to prove that they are especially active when the *Sagartia* takes some food into its stomach, thus, by their natural central position, they not only guard the reproductive organs against any injury from hard particles which are received as food into the internal cavity, but they most probably also facilitate the maceration and digestion of the food. The ready nutriment, or chylus, must be absorbed by the entire inner surface of the body, for no special organs are observable for its distribution.

1. Next in importance, for the existence of the animal, appear to be the *acontia*, which are also flat bands consisting of *cnidæ*; these being likewise arranged transversally in two rows on either side, leaving a narrow space in the centre which is, however, in the present case occupied by large transparent cells, a very small quantity of a fine granular substance, and by *cnidæ* of different size (see figs. 9, 9a, 9b, pl. XI). The marginal *cnidæ* are projecting at the edges about one-fourth or one-fifth of their length, and not unusually have their *ecthoræa* ejected. The *cnidæ* of the *acontia* are distinguished by their great length (some of them being above  $\frac{1}{10}$ th of an inch); they are either straight, or more often slightly curved, and almost equally attenuated on both ends. The *ecthoræa*, when ejected, often exceed the *cnidæ* by one half of their length, and are sometimes doubly as long; their thickness is about  $\frac{1}{15}$ th of that of the *cnidæ*, being hollow and provided nearly to the tip with short, reversed cilia (fig. 9a, pl. XI). It is not improbable that the *ecthoræa* of all the other kind of *cnidæ* are also bearded, but I have not been able to observe their minute cilia. The cellular substance in the centre of the *acontia* is transparent, but the large number of the marginal *cnidæ* produces a milky white colour, which strongly contrasts with the purple colour of the *ovaria* and the yellowish *craspeda*, and thus makes the *acontia* readily discernible.

The *acontia* are in constant motion, expanding and contracting, and winding up and down in different directions; their movements being much quicker, than those of the *craspeda*. Their length

generally amounts to three or four inches, probably sometimes more. I have seen them ejected on every part of the column, even at the base, when the animal is forcibly removed from its place of attachment, in which case the large number of the *acontia* forms a regular net work round the animal. It is, I believe, principally due to the bearded ecthoræa of the *cnidæ*, that the *acontia* stick firmly to every thing which they meet, until the hooks are forcibly removed, or until the organs themselves relax. For small animals the *acontia* are, therefore, formidable weapons, and there can be little doubt that the fluid of the *cnidæ* acts as a kind of poison, in the same way as it does in the *Acalephæ*.

The different modes of emitting the *acontia* from the body will be mentioned subsequently, but I must make here some observations regarding their internal attachment, although it is very difficult to pronounce a conclusive opinion on this point. I have dissected several specimens for the sole purpose of obtaining a clear idea as to the places where the *acontia* originate,\* and it always appeared to me that some of them are attached at the larynx, between the ovaria and the craspeda, but at the same time there seem to be some of them fixed below, near the centre of the base, between the muscular thickenings of the mesenterial folds. I am not aware whether any thing about the attachment of the *acontia* has been previously observed, and it is possible that the basal attachment is only auxiliary to the one at the larynx, so as to support the muscular power required for their emission.

m. Each *ovarium* consists of two parts, one placed on either side of the primary septa. The *ovaria* are long undulating strings, which are firmly attached with one end on the internal side of the larynx, then partially all along the internal cavity between the mesenterial folds, and loosely by some threads to the base. The halves of each pair are perfectly symmetrical, they run in a slight curve, generally parallel to the convexity of the column. The colour is a bluish purple, slightly varying in tint in different specimens.

\* This operation is indeed not so simple, as it would appear, judging from the transparency of the animal. As soon as a portion of the *Sagartia* is cut off, it immediately contracts to such a degree that it is almost impossible to observe separately any of the internal parts.

Blainville was one of the first who pointed out different sexes in the *Actiniacea*, and since then, it has been repeatedly stated, that some of the species are hermaphrodites, while others appear to be sexually distinct. I have examined a large number of specimens of the present species, and always found the ovarian strings consisting of *ova* only, being connected by thin threads, attached to a conspicuous median string, and enveloped in a pale purplish coloured mucous substance, (see pl. XI. figs. 10, 10a, 10b). The eggs usually were of various sizes, some of them small, evidently in a young stage, others much larger, those of largest size measuring about  $\frac{1}{45}$  of an inch in diameter, so as to be distinctly visible even without a glass, (see fig. 10a, pl. XI). The apparently ripe eggs were perfectly globular, each attached to the ovarium by a thin string, it possessed a markedly thickened epidermis, surrounding a finely granular dark substance, and having a large, usually eccentric transparent spot, with a minute opaque centre, (see fig. 10b, pl. XI). Besides these eggs there were always smaller and larger globular masses of irregular shape visible; they were in a constant rotating motion, and probably represented earlier stages of *ova*, or others in a state of furcation. Boiled in hydrochloric acid, the *ova* remained almost unchanged, from which it would seem that their epidermis partially consists of *chitin*, which I have reason to believe is also represented in the integument. In the mucous substance of the ovaria *cnidæ* are sometimes observed of an elongated oval shape, having a thin remarkably long and strongly bearded *ecthoræum*, as represented in fig. 10c on pl. XI.

With respect to the sexual difference of our *Sagartia*, I have to record the following observations which, when confirmed, may throw some light upon the generative system of the *Actiniacea*. After having kept the specimen, figured on pl. X, and the history of which I shall relate subsequently, for about 18 days in my aquarium, it began in small quantities to issue from its mouth a milky white, viscous substance which, upon examination under a very high power of the microscope, appeared to consist of small round globules of different sizes, not however exhibiting any motion. There were only a few *cnidæ* interspersed in that mass. Sickly *Actiniæ* are said often to issue a similar white substance, but in the present case I could not

see the slightest distinction between the character and form of those granules (pl. XI, fig. 11) and early stage of eggs, attached to the ovaria themselves, except that the former were deprived of the purple coloured coating, which always surrounded the latter, when connected with the follicles of the ovaria. In connection with the white viscous mass, there were occasionally issued pale yellowish, contorted bands. Each of these consisted of a thin but tough, almost leathery skin, with numerous irregular partitions (pl. XI, fig. 12) filled with extremely minute spermatozoa; on one side the edge of the band was considerably thickened. The spermatozoa appeared as round globules, each with a very thin and short tail (pl. XI, fig. 13); their motions were extremely rapid in all directions, and whenever a few eggs were introduced into the mass, the spermatozoa were seen collecting round each (pl. XI, fig. 14), until they formed a regular coating to it. Eggs observed a few hours afterwards, distinctly exhibited a motion of their fluid contents, but I have not been able to trace their further changes and development. It is not at all improbable that the spermatozoa, and in fact the whole of the male follicles, are developed, as in many other corals, either at a certain season of the year, or at a certain age of the animals. The act of fructification may result in the death of the animal, but this is not at all likely to be always the case. I shall subsequently again recur to this subject in somewhat more detail, as connected with the existence of the animal.

### *c. Physiology.*

In tracing out the principal physiological phenomena of the present *Sagartia*, I may best attain my object by briefly relating the history of the specimen figured on pl. X.

The specimen was obtained, on the 22nd March, 1868, in a tank close to the railway station of Port Canning. I filled my aquarium with a quantity of the same brackish water, and placed the specimen with several others of smaller size in it. During the first ten days, the large specimen exhibited great activity, usually having its tentacles spread out, attacking every small animal that came in contact with them. The six primary tentacles, being considerably thicker than the rest, were bent out in a curve, usually leisurely

moving about between the bases of the other tentacles. The least touch with a solid object of any part of the body, or even an unusual movement of the water, or the sudden direction of the sun's rays against the animal instantly effected its sensitiveness, the effect being a total or partial contraction of the body. At this act a quantity of water was emitted, and generally a few *acontia* were ejected from the cinclides of the collar, this being done with such a force, as to make the *acontia* rise nearly two inches in a perpendicular direction. They usually remained for a few moments in the extended position, and were then gradually rolled up in a closely coiled spiral line and retracted. Seldom were there any *acontia* seen to issue from any other part of the column. According to the magnitude of the disturbance, from one to about five minutes elapsed before the animal, when it had once entirely closed the disk, expanded again.

After the first ten days, the specimen gradually lost somewhat of its high sensitiveness; it almost constantly remained expanded, but the tentacles were much less active than before, and it required a rather forcible touch to induce the animal to retract them. In a similar manner, the expansion of the body, or the unfolding of the tentacles was remarkably slow, though the animal would not voluntarily remain closed longer than five or six minutes. Other specimens, however, which also partially lost their original sensitiveness, would remain closed for several hours; some of them did not expand their tentacles, even for many days, at least not in the day time.

The *acontia* were always first discernible to begin their movements near the centre of the base, proceeding towards the periphery, then rising along the wall of the column, till they met a *cinclis*, through which they were ejected; they did not, however always rise as high as the collar. When they came in contact with a foreign object, they attached themselves so firmly, that they had to be removed with force. This attachment is, as I have already stated, undoubtedly due to the serrated or bearded *ecthoræa* of their *cnidæ* which are of considerable length. The ejection of the *acontia* is almost momentaneous, but the retraction sometimes extends over 8 or 10 minutes, or even longer;—in a perfectly healthy animal for about three minutes. When the *acontium* is retracted within the body, it again usually remains lying for sometime along the wall of the column, or is coiled up at the

periphery of the base, till it wholly disappears towards the centre. I have never seen any *acontia* issuing from the tentacles, or any part of the disc; as a rule they are emitted only from the sides of the column, but when the animal has been removed from the place of its attachment, I have seen them as already stated, to be emitted from the base near its periphery.

Gosse says that each *cinclis* is not assigned to a special *acontium*, but that at the contraction of the animal, a quantity of water is thrown out, carrying the *acontia* with it, and issuing them through any *cinclis* which happens to lie nearest. This appears in general to be correct; but at the same time it can, I believe, hardly be questioned that some muscular power is connected with the issue of the *acontia*, and perhaps the motion of the water only supports the former principal action, and directs the *acontium* towards a *cinclis*. It would be, for instance, impossible to understand why in the fresh and healthy animal, nearly all *acontia* issue at the collar; and besides that some of them are under circumstances issued with great force in a contracted state of the animal, where extremely little water is given out. Moreover it is very probable that the same muscular power which retracts the *acontia*, after they were ejected, is also in operation at the act of their emission.

Regarding the digestive system of which I have previously treated, I must here record a very interesting observation, inasmuch as it supports the suggestions previously made. I fed a large specimen with a small Crustacean, after it had been slightly pressed, so as to reduce its active motions, and prevent its escaping from the mouth of the animal. The *Sagartia* kept the Crustacean for about five minutes between the lips, and then by almost insensibly slow movements of the labial muscles gradually swallowed it down. When this had been done, it remained in a half contracted position for more than an hour. During this whole time the *craspeda* were seen much more actively moving about, than either before or after that. The Crustacean was actually so thoroughly enveloped in the net of the *craspeda*, that I could not trace its form; even the next day the *craspeda* were seen more approximate and arranged round the central space, than they were on former occasions. This observation appears to be in favour of my previous statement, that the

physiological signification of the *craspeda* is to some extent that of secretive organs, as liver, gall, pancreas &c., being essential for the digestion of the food. It would be probably going too far in stating that the ready chylus is also conveyed through the *craspeda* to the body, though the anatomical structure of their central portion is not directly opposed to this opinion. There can be however, little doubt that by the numerous marginal *cnidae*, the *craspeda* have among others the object of protecting the generative organs from any injury which could be produced by the objects taken internally as food. The *acontia* evidently only serve for external defence, they do not seem to have any other physiological duties to perform.

Passing these remarks, I may return to the history of our specimen. It remained in the less active state, as previously described, for about 8 or 10 days. After this time it generally somewhat retracted the tentacles raised the disk and the lips (pl. X, fig. 7), and began to emit from the mouth a granular substance, the granules appearing, as I have already noticed, to be eggs in very early stages of development. The white substance was extremely viscous, and in irregular masses more or less resembling contorted strings. The next day I observed that, besides the white substance, there also were pale yellowish strings issued, containing the very minutest spermatozoa, as above described (p. 47). This issue of white substance, with eggs (?) and spermatozoen follicles lasted in intervals for two days, after which the specimen began to expand and contract its body in various ways. The tentacles were reduced to about half their usual length, the lips were projecting, the disc was occasionally produced, then again retracted, the collar more or less inflated, and at the same time, either the upper or the lower part of the body attenuated and extended, sometimes to more than double the usual length, (see pl. X, figs. 6, 8, 9). These various transformations of the body were observed for about 8 hours, during which time the *Sagartia* left its former place of attachment, (being a small piece of wood) and was seated at the bottom of the aquarium, on a horizontal ground. The next morning the specimen was found flat, perfectly turned inside out, exhibiting all the internal organs, (pl. XI, fig. 1). The *acontia*, *craspeda*, and even the tentacles shewed subsequently signs of vitality for more than 24 hours. Upon examining the figured, and another specimen which died under similar conditions,

I found that the eggs on the ovaria were rather larger than usually in other live specimens, and the spermatozoa were accumulated in large numbers between all the mesenterial folds, and some of the pale strings which contained them, appeared to be attached irregularly between the ovaria. In a third instance they almost seemed to me that they have taken the place of some of the craspeda.

The important question resulting from this observation is, whether the death of the specimen was an accidental, or a natural one. I would not in the least deny, that the somewhat different conditions under which the animals were placed, accelerated the death of two of the specimens, but it would be strange to affirm that their death was caused merely by these different conditions,\* inasmuch as they had hardly any influence upon other specimens, living in the same aquarium, and remaining healthy for a long time. Before those observations were made and afterwards, I had at different times dissected several specimens, but I never found a trace of any spermatozoen follicles, or any spermatozoa between the ovaria, though the ova were sometimes of large size and highly developed. I have, never observed internally any young *Sagartiæ*. Still it appears very probable that the present species is like many other *Actiniacea* viviparous, this being the ordinary course of propagation. I have likewise not observed any buds or stolones, or a natural division of any of the specimens. However, either at certain times of the year or, more likely, at a certain age the male follicles may be formed and spermatozoa developed in large numbers. The death of a specimen after the act of fructification may be only an accidental one, but this has still to be confirmed by other observations. In the specimen of which I have given the history, the eggs remained after its death perfect, only loosened from the ovarian strings, while the other animal substance quickly decomposed. Gosse says that he once observed an *Actinia* issuing spermatozoa, but he does not state whether the act resulted in the death of the specimen or not. Blainville's observations, if I remember rightly, gave a distinct proof that in some species ovaria and spermatozoa are developed in one and the same specimen.

\* Being probably a slight alteration of the percentage of the saline constituents of the water, caused by evaporation, (though this percentage was maintained as much as possible), greater exposure to light and increased temperature, want of sufficient motion in the water, etc.

It is usually stated that, when an *Actinia* is cut into a number of pieces, each restores itself to a perfect animal. Though this kind of propagation no doubt has its limit, I may, record, that experiments made on some specimens of this species in general confirm the great vitality and reproductive power of the *Actiniacea*.

With the object of observing some of the ovaria, I once cut a specimen in two halves, and left one part of it in water attached to a piece of wood. In about 24 hours I found the half *Sagartia* closed again and after a few days the animal was perfectly restored, only counting a smaller number of septa, but even these were in time partially replaced. The specimen, however did not grow larger, although I fed it with mosquitoes and various larvæ for about six months. The other half which was removed from its place of attachment died shortly afterwards.

d. *Habitat*.

It is generally stated that all the *Actiniacea* are truly marine animals, and there are indeed very few instances known where species have for a time been kept in aquaria in which the saline constituents of the water were in proportion considerably less, than represented in pure sea-water. *Actiniæ*, and others, are sometimes found attached to rocks above the low-water mark, or living in small pools of sea-water, but I am not acquainted with any record of a species having been observed living permanently in brackish water.

The present species was found, as I have already stated, in one of the tanks close to the railway station of Port Canning. It lives here attached to old trunks of trees.\* I have not observed it in any of the other tanks, partially on account of a difference in the water, partially on account of the want of any fit places of attachment. The specimens which I collected were of different size, the smallest about one quarter of an inch in the basal diameter, and the largest measuring about  $1\frac{1}{2}$  inches in the same diameter. They usually were seen 8 or 10 inches below the surface of the water but sometimes at the surface itself; sometimes even a part of the animal was above it, and while the exposed portion became perfectly dried up under the direct influence of the sun, the other half remained as usually vital.

Slight progressive movements have often been observed in *Actiniæ*

\* Hæckel's name *Petracalephæ* would on this account not suit this species, we had to create a name something like *Lignacalephæ*.

and I may mention, that one of my specimens moved in 24 hours by gradually contracting and expanding its base\* four inches on a level horizontal bottom, and three inches on the perpendicular side of the glass, so as to reach the surface of the water; in all therefore seven inches. All the specimens shewed a particular liking to move nearer to the surface of the water. The above shews that the *Sagartia* has the power to move progressively at about the rate of 0.26 of an inch in one hour, which is comparatively a very quick motion for these usually sessile animals.

The species is also common all along the banks of the Mutlah river. During low water the specimens often remain for hours exposed to the direct influence of the sun, attached to wooden pillars, stems of trees, &c. Each specimen always retains a large quantity of water during the time of exposure, and gives a portion of it up when disturbed.

In conclusion I have only to mention a few words regarding the chemical constituents of the brackish water, in which the animals were found living, as compared with those of sea water. Mr. D. Waldie, who very kindly undertook to make an analysis of the water, tells me that 1000 grs. contain a total quantity of solids of 12.87 grs., of which are 0.78 sulphuric acid (anhydrous), 0.78 magnesia and 0.23 lime. Mr. Waldie further observes, "the arrangement of the constituents is arbitrary; supposing the acids and bases are combined in accordance with the analyses usually given of sea-water, it will stand as follows:—

|                                                 |       |
|-------------------------------------------------|-------|
| Chloride of Sodium (including potassium), ..... | 9.81  |
| „ „ Calcium, .....                              | 0.46  |
| „ „ Magnesium, .....                            | 0.93  |
| Sulphate of Magnesia, .....                     | 1.17  |
| Carbonic acid, &c., .....                       | 0.50  |
|                                                 | <hr/> |
|                                                 | 12.87 |

This will be found very nearly the composition of sea-water as to its principal constituents, but in quantity amounting only to very nearly one-third of sea-water for the same volume of water." Dana in his Manuel of Mineralogy also states that the amount of solid substances in sea-water changes between 32 and 37 parts in 1000 pts. of water.

\* Measuring about one inch in diameter.

We may, therefore, say that the brackish water from Port Canning is composed of very nearly *one part of sea, and two parts of river-water*.

The occurrence of a species of *Sagartia* in brackish water, resembling in nearly all respects of its organisation marine species, is one additional fact how often an animal has it in its power to select or change the conditions of its life. It does not apparently depend so much on the quantity of certain solid constituents, composing sea-water, as it does on their presence in general; smaller quantities of them may occasionally have no effect upon the animal life, but the absence of one or the other of them could likely produce a thorough change in the fauna.

Considering the great disturbances of the atmosphere which have taken place towards the close of the last year (1867), we could suppose that these corals may have been transferred from the sea coast in the tank accidentally. This however is not the case. Although the water of the river is subject to constant changes of flood and tide, and contains a large proportion of fine mud and silt, which undoubtedly would greatly interfere with the existence of most other corals, the *Sagartie* live in it in large numbers. I also found them several miles north of Canning, in the tributaries of the Mutlah river, where the water is often much less brackish than further south. Besides the *Sagartie* there are in the same tanks at Port Canning, and in the neighbourhood, a large number of most interesting species of Mollusca living which mostly belong to marm types. Many of the animals may die or otherwise become less active, when during the monsoons the water of the tanks is nearly quite fresh, but some of them certainly must survive. Pure fresh water, or even that of the Hooghly obtained at the height of the flood, acted injuriously on the *Sagartia*. The animals, when placed in it were momentarily paralysed, though exhibiting vitality for some time afterwards, but they died in about 24 hours; still I think it very probable that the specimens would gradually and in time get accustomed to the Hooghly water also and they probably also occur in this river further south, and nearer the sea.

I have associated with this extremely interesting species, which gave me the opportunity of observing so many new points regarding the anatomy of the *Actiniacea*, the name of my friend, *Ferdinand Schiller*, who has been so actively engaged in the improvements of the locality where the species was discovered.

*Phylum, MOLLUSCA.**Sub-phylum, HIMATEGA.\**

These animals are also called *Moluscoidea*,—they are without a complete nervous system, the heart is wanting and if present it is without an auricle.

*Class, BRYOZOA OR CILIPODA (Polyzoa, auctorum).*

Heart and special organs of sensation wanting.

*Sub-class, GYMNOLEMA.†*

With a simple row of tentacles.

*Order, CHILOSTOMATA.‡—(Cellulinea d'Orb.)*

Cells more or less ovate, aperture not produced, closed by an operculum or a muscular lappet.

*Sub-order, INCRUSTATA.*

Cells more or less attached by the entire, or a portion of their base.

*Tribe, MEMBRANACEA.*

Cells above wholly or partially membranaceous, the aperture being situated in that membrane.

*Family, FLUSTRELLARIIDÆ.*

Cells without special pores.

*Genus. MEMBRANIPORA, Blainville.*

Cells large, depressed, their single layers generally incrusting different objects; upper portion mostly membraneous; aperture with simple, entire margins, situated at the anterior end.

*Species. Membranipora Bengalensis, Stoliczka, 1868.*

## PL. XII.

*Memb. polyzoario semi-calcareo, simplici, incrustante seu varie torto; cellulis depressis, sexangularibus, longioribus quam latis, in seriebus alternantibus positis, supra membranaceis, minutissime porosis, infra ac lateraliter calcareis, in adultis ad marginem superiorem nonnullis spinis solidulis paulum elevatis instructis; apertura in adultis speciminibus sub-rotundata, antice ad terminationem sita, marginibus integris aliquantum prominentibus circumdata; margine posteriori paulo producto atque sæpius quatuor spinis postice prolongatibus instructo:*

\* Hæckel, *Generelle Morphologie*, Berlin, 1866, Vol. II. p. cv.

† The other sub-class form the PHYLACTOLEMA.

‡ The other orders are *Cyclostomata*, *Otenostomata*, *Paludicellea* and *Urnatellea*.

*spinis inæqualibus, exterioribus brevioribus quam interioribus. Animal virescente album, tentaculis longis, 14-18 instructum.*

*a. Form of cells.*

The polyzoarium of this species is extremely variable, its form being altogether dependent upon that of the object to which it is attached. It is either found incrusting stones or wood, or it grows on different water-plants, being then variously contorted and apparently partially free. According to this the cells undergo many variations, often so much so that it is extremely difficult to determine the characters of the species.

As a rule they are hexagonal, slightly elevated, about twice as long than broad and posteriorly emarginated (pl. XII, fig. 1, f). The base and the sides are in full grown cells always solid, the upper portion more or less membranaceous, representing a usually slightly convex, very thin covering. The upper margins of the solid portion of the cell,—where the thin membrane is attached—are somewhat raised, and each cell is separated from the next by a slight furrow. The aperture lies at the anterior end, being roundish and provided with somewhat thickened, elevated and solid lips. The anterior portion of each cell with its margin extends into the basal indentation of the previous one, while the posterior margin of the aperture is much more prominent, possessing a small thickened projection which is posteriorly often prolonged into four, radiating spines, the outer pair of these being much shorter than the inner one (see pl. XII, fig. 2).

In consequence of the greater elevation of the posterior margin the aperture, when viewed perpendicularly from above, appears almost semicircular, but viewed at about an angle of 45 degrees from the front its round shape\* is distinctly perceptible. The posterior upper portion of the cell is always convex, thin, finely perforated, and according to the different stages more or less solid. The radii or ribs originate at the upper lateral solid edges and extend in a more or less regular way from both sides toward the centre. Sometimes, but not usually, they unite in the median line and form solid cross bars. The length of the radii also varies with the age of the cells, but their number appears entirely to depend upon the length of the cells, (see figs. 3, 4, pl. XII).

\* I mention this point here particularly, because the same *roundish* form of the aperture also occurs in many marine *Celleporæ* and *Lepraliæ*, and is usually stated to be semilunar, though in reality it is not so.

In live specimens, the cells are so thoroughly transparent, that their detailed structure is very difficultly noticed; but in dead cells the membranaceous covering generally disappears, and the solid radii or spines are seen to project towards the median line. It is, however, not always the case that they can be observed, even when the cells appear well preserved. On account of their great tenderness, they not only become in dried specimens variously contorted, but are often very easily broken off; such is the case in almost all the fossil *Membraniporæ*. In some, even very old cells however, they remain rudimentary, or do not develop at all, with the exception of one posterior, median spine which is always present. Again other very old cells become entirely incrustated, even at the aperture. All these variations of the form of the cells and the differences in the arrangement of the marginal spines are amply exhibited in figures 1-4 of plate XII, and these will give a better idea of those changes than any lengthened description.

I hardly need to notice the great importance of the study of those structural differences of the cells in one and the same species. In the present case, I find that the cells which spread over a large flat surface usually are short and broad (fig. 3), those which incrust small, thin stems of water plants, and the like, are much elongated and narrower (fig. 4). Were these forms not passing one into the other, and had the animals not in each case been observed, one would certainly may think to have a good reason for acknowledging these forms as distinct *species*. How different would this be in the case of their being fossil *Lepraliæ* or *Membraniporæ*! It is certainly true that we often describe merely fossil forms, and not species.

Only the sides and the base of the cells are, as I have previously stated, solid; they are chiefly composed of carbonate of lime, forming a thin porous layer. Each cell communicates through a large pore with each of the six adjoining cells. Two of those larger pores are found on each side and one in front and one behind. Sometimes, however, in younger cells the number of large pores is greater. When the polyzoarium is partially free, for instance in growing round a quantity of algæ, each cell usually has at the base a long membranaceous tube, through which a muscle, originating at the lower side of the mantle, is protruded, attaching the cell to the plants, (figs. 7 and 8). The round opening

of this tube broken off, with a slightly raised margin, is generally visible near the centre of the base of each dead cell, when carefully removed from its place of attachment; it is rarely wanting except in very old cells (see pl. XII, figs. 5 and 6). When, however, the cells are firmly attached with their entire base the opening often becomes closed up, and in time disappears altogether. Viewing the basal portion of a polyzoarium each cell appears separated from the others by a raised margin, while their median portions usually are slightly excavated. The surface is finely porous. The usual colour of the cell is pure white, occasionally slightly opac or brownish.

*b. Animal.*

There is little of special interest that I can mention with reference to the animal of this species. It is enveloped in a perfectly transparent mantle, which lines the internal, slightly rugous surface of the cell, and appears to be firmly attached to it posteriorly and at the margins of the aperture (see fig. 1, *f*, pl. XII). When the cell is broken and the animal taken out, the mantle generally remains with the cell; it is therefore very difficult to trace out the connection of the animal to its mantle. I have only observed a few very thin muscles posteriorly, but none anteriorly, though they also may exist. Equally difficult is it to observe the animal expanded, because the slightest motion of the water compels it to remain closed for a long time. When it protrudes out of its cell, the total length of the tentacles and a portion of the collar is visible. In the retracted position the *V-form* twisted viscera can be clearly traced through the cell-membrane. In the animal, taken out (fig. 1, *h*) of its cell, the length of the retracted tentacles (*t*) measures nearly one fourth of that of the entire body; they are separated by a groove from the muscular larynx, in the centre of which lies the mouth; then follow the viscera, usually somewhat contorted, being thickest in the middle, and by a sharp twist joining the membrane which surrounds the tentacles at about one-third distance from their base. At the end of the visceral cavity, there is usually seen one, seldom two or three oval, dark bodies,—probably *statoblasts*. These viewed under the microscope, seemed to be filled with a rather homogenous, granular mass, but sometimes there was a contorted,

dark string visible, and the rest was filled with a clear fluid (fig. 1 *i*). Whether this difference is due to different stages of growth I am not in a position to say. I have not observed their development in the present species, but I hope to recur to this subject at some future occasion, when treating of the development of some of our fresh-water Bryozoa.

The microscopical structure of the animal is a granular, or cellular substance in which numerous greenish pigment cells are interspersed. There is no trace of *cnidæ*, such as described in the *Actiniacea* and *Acalephæ*. The tentacles generally are moved about slowly, not being usually widely separated from each other, and the movements of each are independent from those of the other, they also often have the tips bent outward, (see fig. 1, *g*, pl. XII). It is generally stated that the tentacles of all the Bryozoa are tubular, but in the present species it always appeared to me, that they are flat bands with the lateral edges folded in, so as to leave a broad furrow in the middle. They consist of about six or seven rows of large angular cells, being finely ciliated on either side. The cellular structure is perfectly different from that of the tentacles of the corals, but remarkably resembling, for instance, that of the tentacles or eye-pedicles of small Gastropoda (see pl. XII. fig. 1, *k*).

### *c. Growth of the polyzoarium.*

The progressive growth of the polyzoarium of the present species deserves a short notice, inasmuch as the observations on this point are as yet rather imperfect.

The terminal end of each fresh polyzoarium (see fig. 1*a*) is very thin and membranaceous, being wholly composed of young cells, in different stages of development. It is in all the incrusting species of this group of Bryozoa free, becoming attached only in an advanced age. The first stage (1*b*) appears to be that of a small, flat and homogenous cell, filled with a quantity of a dark granular substance. This cell is produced in the form of a knosp from the previous cell of the same row. Young cells, especially seem to have the power of propagating themselves by buds, but in the old cells this mode is replaced by the formation of statoblasts.

In a next stage, subsequent to that above mentioned, cells are observable in which the granular substance is a little reduced, but generally in the right basal corner a dark spot becomes visible with a translucent centre. This is the first distinct embryonal form (fig. 1c). Subsequent to this the upper edges of the sides of the cell and the base become more solid, (fig. 1d), then a small spine appears posteriorly, but no aperture as yet in the upper membrane, though it seems to be indicated by an opac-line (fig. 1e). In the transparent centre of the embryo there are furrows to be observed, radiating from the centre and indicating the formation of the tentacles; a few thin muscles are also seen attaching the young animal to the posterior end of the cell. After this, the development appears to make more rapid progress; the body extends, the twisted viscera become perceptible, the membrane covering the aperture is absorbed and the basal string which gives the cell a fixed position developed (fig. 1f). Thus the animal is seen perfect, lying in the cavity of the cell, and the mantle becomes attached all round the margins of the aperture. At a progressive age, the statoblasts appear in the posterior portion of the visceral cavity, and the upper membrane of the cell gradually attains a greater solidity by a number of thickened radii or spines. All these stages of cells may often be observed on only a small terminal portion of a large polyzoarium (fig. 1). The basal string is very strong in the young cells, but becomes obsolete in advanced age, as I have previously mentioned, it is therefore only a temporary organ, and not essential to the existence of the animal.

I also may notice at this opportunity that I observed on one of the polyzoaria, small membranaceous tubes attached between each two cells, near their apertural margins. Out of these tubes an organ was voluntarily, and independent of the animals in the cells, projected and retracted. It simply consisted of two fleshy *flagellæ*; these were probably the so called *avicularia* the true nature of which,—as apprehensive organs,—is as yet little known, but the surface was so much covered with different *Spongillæ*, that I was unable to trace the immediate condition of these supposed *avicularia* with the cells themselves. When the polyzoarium was dried, the membranaceous tubes and naturally also their contents disappeared.

*d. Chemical composition of the polyzoarium.*

When boiled in hydrochloric acid, the polyzoarium left as residue a very thin membranaceous skeleton; it was complete as regards form of the cells. This membranaceous skeleton could hardly be anything else, than chitin, as distinguished from the common horny substance by being insoluble in hydrochloric acid.\* Subsequently I burned several portions of the polyzoaria in a platina crucible, until every trace of organic matter disappeared. The cells were by this operation not materially affected, but placed in hydrochloric acid, they were almost perfectly dissolved, they seem therefore to a very large proportion to consist of carbonate of lime. There was a small residue of siliceous spiculæ and scleroid particles left, but these were most probably derived from the numerous *Spongillæ* adhering to the cells.

*e. Habitat.*

*Membranipora Bengalensis* was found at Port Canning with *Sargatia Schilleriana* in the same tank of brackish water; it is, however, much more widely distributed as the last. It also occurs in tanks, the water of which contains only about one fifth of sea-water. I found the species incrusting old trunks of wood on several places along the Mutlah river, on many points in the salt-lakes and in other places of the Sanderban. The present species does not, however, occur in fresh water, where it appears to be replaced by *Hislopia*, evidently belonging to the same family of *Chilostomata*. There are a large number of similar forms found on various places of the coast of the Bengal Bay. One of these, with smaller cells, is often seen on shells and fragments of wood coming from the lower portions of the Sanderban, but it is difficult to obtain it in good preservation.

A marine species which I lately collected at Ceylon and at Aden is very like the one here described but it has the cells much more solid.

\* The plates at the entrance of the œsophagus, or the so-called theeth, have been found also to consist of chitin.

*Explanation of Plates.*

## Plate X, (p. 33).

- Fig. 1. Unfolded specimen of *Sagartia Schilleriana*, in natural size (see p. 33); 1 *a*, a portion of a tentacle of the second series; 1 *b*, a portion of a tentacle of the first series, both enlarged twice the natural size; 1 *c*, termination of a primary tentacle, with the *cnidæ* arranged in spiral rows, six times the natural size; 1 *d*, longitudinal section of one tentacle, shewing the different layers of which it is composed, (p. 39).
- Fig. 2. Top-view of the specimen represented in fig. 1, when in a half contracted position, (p. 34).
- Fig. 3. Side-view of the same, with the ovaria visible through the transparent body, the tentacles half protruding, and several *acontia* ejected.
- Fig. 4. Side-view of the same specimen in a fully contracted position, the transverse rugations being more distinct than in the former positions, (p. 34).
- Fig. 5. View of the basis; numbers 1-5 shewing the 5 series of the septa; the dark spots, each situated on either side of the primary septa, represent the *ovaria*, and the striped marks, more centrally situated, the bundles of the *craspeda*, (p. 35.)
- Figs. 6—9. Side-views of the various abnormal forms of the same specimen, (p. 50).

## Plate XI, (p. 35).

- Fig. 1. View of a specimen turned inside out, the primary septa and the ovaria accompanying them being prominent, (p. 50); 1 *a*, represent three shrunken tentacles, enlarged.
- Fig. 2. Ideal representation of the distribution of the septa and tentacles according to the different circles (p. 40).
- Fig. 3. Ideal perpendicular section of a *Sagartia*, in half of its basal diameter, (see explanation of the various letters on p. 35).
- Fig. 4. Appearance of the mucous layer, enlarged 200 diameters; 4 *a*, a few isolated *cnidæ*, enlarged 500 diameters (see p. 36).
- Fig. 5. Upper or outer view of the scleroid tissue; 5 *a*, the internal view of the same; 5 *b*, calcareous scleroids; 5 *c*, siliceous scleroids, very much enlarged, (p. 37).
- Fig. 6. A portion of the scleroid skeleton, after the specimen was burnt in a crucible (see p. 38).
- Fig. 7. *Cnidæ* of the tentacles (p. 40).
- Fig. 8. Longitudinal section of a portion of a *craspedum*, and 8 *a*, its *cnidæ*, more enlarged (p. 43).

Fig. 9. Longitudinal section of a portion of an *acantium*; 9 *a* and 9 *b*, its *cnidæ* (p. 44).

Fig. 10. A portion of an *ovarium*, 10 *a*, shewing the distribution of the eggs in the mass; 10 *b*, eggs much enlarged; 10 *c*, one *cnida* from the ovaria (p. 46).

Fig. 11. Appearance of the spermatozoa slightly enlarged.

Fig. 12. Male follicle, (see p. 50).

Fig. 13. Spermatozoa, very much enlarged.

Fig. 14. Eggs surrounded by spermatozoa, (p. 47).

Plate XII, (p. 55).

Fig. 1. Natural size, of a portion of the polyzoarium of *Membranipora Bengalensis*; 1 *a*, enlarged, with two supposed *avicularia* on the left corner; 1 *b*,—1 *f*, various stages in the development of one cell (see p. 59); 1 *g*, a full grown cell with the animal partially protruding, the body seen through the transparent cell; 1 *h*, the animal taken out (p. 58); 1 *i*, a statoblast; 1 *k*, internal view of the terminal portion of a tentacle (p. 59).

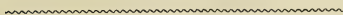
Fig. 2. Front view of a few cells, greatly enlarged, also shewing the spines attached to the lower lip (p. 57).

Fig. 3. Front view of a number of cells of an oval shape; 3 *a*, much enlarged portion of the upper surface, with two transverse, solid radii.

Fig. 4. Much elongated cells which were attached to a stem of a plant.

Figs. 5-6. Back-views of two kinds of cells, corresponding to figures 3 and 4.

Figs. 7-8. Side-views two cells, shewing the lateral pores by which they communicate with the adjoining cells, and also shewing the lower string which is well developed in young cells.





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## PART II.—PHYSICAL SCIENCE.

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*On some new marine Gastropoda from the Southern Province of Ceylon;—by MESSRS. G. & H. NEVILL.*

(With plate XIII.)

[Received and read 5th August, 1868.]

The seven new species described in this paper, are the first of a considerable number of new shells, found by ourselves in Ceylon. Up to the present, we have succeeded in identifying over 1,000 species, and are still obtaining many fresh additions, some of which are very interesting forms, and of which we trust, before very long, to publish as complete a list as possible. Ceylon has been much neglected in this respect, as regards marine Mollusca, nothing having been published about them, except the list in Sir E. Tennant's admirable work which, however, only mentions some of the well-known and characteristic Trincomalee species.

Of the shells here described, two belong to the genus *Oxynoe*, proposed by Rafinesque in the "Journal de Physic" of 1819, for a shell from the Mediterranean, *O. olivacea*; the description is a very good one. Mörch in the "Journal de Conchyliologie" for 1863, Vol. XI, mentions nine species as belonging to this genus, namely—

1. *O. olivacea*, Raf., Malta.
2. „ *Sieboldii*, Krohn, Sicily.

3. *O. brachycephalus*, Mörch, Loc. ? This species would seem to require confirmation, Mörch having merely described it from H. & A. Adams' figure, intended for *O. Sieboldii*, from which, however, he states it differs too much to be possibly the same species.

4. „ *Krohnii*, A. Ad., Sandwich I.

5. „ *pellucidus*, „ Loc. ?

6. „ *Antillarum*, Orst and Mörch, St. Thomas.

7. „ *viridis*, Pease, Sandwich I.

8. „ *Cumingii*, A. Ad., W. Columbia.

9. „ *Vigourouxii* Montr. and Souv., N. Caledonia.

There can be no doubt, the two last named species, must be removed to the genus *Volvatella*, Pease, (see Amer. Journ. of Conch., 1868, Pt. 2).

We have also here described two species of the rare genus *Cylindrobulla*, formed by Fischer in the Journ. de Conch. of 1857, for a species from Guadaloupe, *C. Beauii*; the only other species, as yet described, is from South Australia, *C. Fischeri*, Ad. and Ang.

Of Krohn's genus *Lobiger*, two species have been described from the Mediterranean, *L. Philipii*, Krohn, and *L. corneus*, Mörch; a third named is from Guadaloupe, *L. Souverbii*, Fisch., and a fourth from Polynesia, by H. Pease, *L. pecta*. (Amer. Journ. of Conch. 1868, Pt. 2).

Three species of *Broderipia* are known from the Philippines, *B. iridescens*, Brod., *B. rosea*, Brod., and *B. Cumingii*, A. Ad. A fourth was described from Bourbon by Deshayes, *B. nitidissima*, the same writer records *B. iridescens*, as occurring at the same locality; we have also ourselves found at Ceylon, the rare and pretty species *B. rosea* and add a new species under the name of *B. eximia*.

The only species of the *Delphinulinæ* at all closely allied to the shell here described, *Cyclostrema sub-disjuncta*, H. Ad., is *Delphinula nivea*, Chemn. Indeed we do not feel quite sure, but that the present is the species originally described under that name, and that the shell described and figured for it by Kiener and Reeve, may prove to be a different one, certainly the two figures in Küster's Conchylien-Cabinet, one after Chemnitz, the other after Kiener, belong to perfectly distinct species; the present shell, if not the same, is very close to the former, but differs essentially from the latter.

## Fam. PHILINEIDÆ.

## VOLVATELLA, Pease, 1860.

**Volvatella cincta**, n. sp. (Plate XIII, Fgs. 4. 4a 4b.)

T. ovato-cylindracea, membranacea, involuta, in medio paululum contracta, utrinque producta; postice abrupte contracta, antice lente rotundata atque subdilatata; apertura postice angustissima, in medio clausa, antice subrotundata, labio paulo reflexo; labro tenui, postice oblique desinente, in medio sinuoso; epidermide cornea, pallide fusca, cingulis latis rufescentibus instructa; striis incrementi minutis, regulariter flexuosis.

Long.  $11\frac{1}{2}$  Mil.—Diam.  $6\frac{1}{2}$  Mil.

Differing from its nearest ally, *V. Vigourouxii*, in the peculiarity of the epidermis and in the anterior part of its aperture being more rounded and not nearly so dilated; there is also no callosity near the margin of the inner lip, the difference in size is equally very great, *V. Vigourouxii* being 24 Mil. in length and  $14\frac{1}{2}$  in breadth.

The animal resembles that of *V. fragilis*, Pease, (Am. Journ. of Conch. Pt. 2. 1868), the colour being bright orange with bands of red aggregated corpuscles; it lives in shallow water on reefs among coral-lines &c.; when molested, exudes a milky fluid.

## Fam. OXYNOEIDÆ.

## OXYNOE, Raf., 1819.

(Syn. *Icarus*, Forb. 1844. *Lophocercus*, Krohn, 1847.)

**Oxynoe delicatula**, n. sp. (Plate XIII, Fgs. 5. 5a. 5b. 5c.)

T. ovata, involuta, postice paulo contracta ac truncata, antice rotundata, albida, tenuis; apertura postice subcircularis, antice ovata, elongata, dilatata, marginibus prope terminationem posticam approximatis instructa, labio levi, tenui, labro postice paulo inflexo, ad marginem acuto.

Long. 6 Mil.—Diam.  $3\frac{1}{2}$  Mil.—Rare.

The much smaller expansion of the outer lip, &c., at once distinguish this species from *O. Sieboldii*, which it most resembles.

The animal of this species proves it to be a true *Oxynoe*, it is of a pale sea green colour spotted with round turquoise blue spots, it is found on reefs in very shallow water.

CYLINDROBULLA, *Fisch.*, 1857.

**Cylindrobulla sculpta**, n. sp. (Plate XIII, Fgs. 3. 3a. 3b. 3c.)

T. cylindracea, tenui, alba, medio angustata, postice sub-gibbosa; sutura postice profunde incisa et ad terminationem truncata; labio incrassato, labro sinuose inflexo; apertura antice subdilatata ac rotundata; superficie striis incrementi minutis, flexuosis, postice crassioribus, prope rectis notata.

Long. 6 Mil.—Diam. 4 Mil.—Very rare.

**Cylindrobulla pusilla**, n. sp. (Plate XIII, Fgs. 2. 2a. 2b. 2e.)

T. elongato-cylindracea, postice sub-gibbosa, truncatim desinente, alba, nitida, pellucida, tenuissima; sutura postica angusta; labro inflexo; apertura antice transversaliter subdilatata, marginibus tenuibus instructa; superficie striis minutis, postice approximatis notata.

Long. 4 Mil.—Diam. 2 Mil.—Very rare.

Rather closely allied to *C. Beauvi*, but differing in the overlapping of the outer lip, &c. There also appears to be considerable resemblance to a shell described by H. Peace as *Volvatella candida*, (*Amer. Journ. of Conch.* 1868).

LOBIGER, *Krohn*, 1847.

**Lobiger viridis**, n. sp. (Plate XIII, Fgs. 6. 6a. 6b.)

T. ovata, involuta, tenuis, virescens, ultimo anfractu postice valde inflata; apertura oblonga, antice attenuata et rotundata, postice breviter producta, sub-angustata; labio tenui, prope recto, levi, lente elevato; labro arcuate expanso, ad marginem tenui.

Long.  $3\frac{1}{2}$  Mil.—Diam.  $5\frac{1}{2}$  Mil.—Very rare.

*L. viridis* differs from the other species of the same genus in being anteriorly much more gradually rounded, as also by its greater tumidity near the spire, &c.

## Fam. TROCHIDÆ.

**Cyclostrema (Tubiola) sub-disjuncta.** H. Ad.

(Plate XIII, Fgs. 1. 1a. 1b. 1c.)

*Delphinula tubulosa*, n. sp. Proceedings Asiatic Society Bengal, August, 1868.

T. tenuis, subturbinata, moderate umbilicata, spira paulo elevata, anfractibus quinis, fere tubulosis, rapide crescentibus instructa, ultimo prope terminationem dissoluto; superficie striis numerosis spiralibus ornata; apertura transversaliter sub-rotundata, marginibus tenuibus conjunctis; labro supra atque ad basin insinuato.

Long.  $6\frac{1}{2}$  Mil.—Diam. 9 Mil.—Rare.

Since the publication of the Abstract of this paper, where this shell is noticed as new, we find Mr. H. Adams has described it under the above name in the Proc. Zool. Soc. (1868, p. 293) from a specimen we sent to him some little time ago.

## Fam. STOMATIDÆ.

**Broderipia eximia**, n. sp. (Plate XIII, Fgs. 7. 7a. 7b, 7c.)

T. regulariter oblonga, patelliformis; apice excentrice sub-postico, paululum incurvo, antice sub-applanato, postice lente convexo; superficie costulis radiantibus, longioribus ac brevioribus alternantibus, prope apicem obsoletis, interstitiis fere æquidistantibus separatis ornata; striis incrementi concentricis, minutis; costulis albescentibus, sulcis fusco-rubidis; testa interna margaritacea, in medio callositate tumescente, incrassata.

Long. 10 Mil.—Diam. 7 Mil.—Alt.  $4\frac{1}{2}$  Mil.—

Somewhat close to *B. nitidissima*, Desh., from Bourbon, though distinguishable at the first glance.



*On Pandanophyllum and allied genera, especially those occurring in the Indian Archipelago; by S. KURZ, Esq., Curator of the Calcutta Herbarium.*

[Received and read 7th October, 1868.]

The genus *Pandanophyllum*, established in 1844, by Dr. Hasskarl in his catalogue of the plants, cultivated in the Botanic gardens at Buitenzorg (p. 297) remained for a long time but imperfectly known, until Dr. Thwaites in his Ceylon plants, and Professor Oudemans in von Mohl and Schlechtendal's "Botanische Zeitung" directed the attention of botanists to this interesting genus of tropical plants.

Some time ago I noticed, in Professor Miquel's supplement to the flora of Sumatra, several species which that author had placed in the genus *Lepironia*, but which doubtless are congeners of *Pandanophyllum*. This circumstance has induced me to examine all the Indian species belonging to *Pandanophyllum* and its allies, and at the same time to describe those species, which occur in the Indian Archipelago, as far as the materials at my disposal allow it. In the present communication, I shall briefly state the results which I have thus obtained, trusting that they will be acceptable to Indian botanists. The new genus, *Thoracostachyum*, of which I shall give a detailed characteristic in the course of this paper, forms to a certain extent a connecting link between *Hypolytrum* and *Lepironia*, but it is sufficiently distinct from both of them, and deserves to be treated as an independent genus of CYPERACEÆ.

*Scirpodendron*, established by the late Zippelius in the Herbarium of the Botanic gardens at Buitenzorg, is the most gigantic of all the CYPERACEÆ I am acquainted with and, when destitute of flowers, it is hardly to be distinguished from stemless screw-pines.

#### HYPOLYTREÆ, N. E.

Spicæ compositæ squamis undiquê imbricatis squamulis squamæ ut plurimum contrarie instructis; spiculæ solitariae, rarius ternæ, squamâ oppositâ obtectæ, compressæ, 1—multifloræ, dielines v. raro hermaphroditæ; flosculi masculi monandri, uni-squamulati, sæpius ad squamulam solam reducti; flosculus femineus centralis v. excentri-

cus, nudus v. rarius squamulatus; stylus 2-3—fidus; achenium v. achenium drupaceum.

I shall at first give a short review of the genera belonging to this tribe of the natural order CYPERACEÆ, and then enter in detail upon the description of the species, as far as this appears necessary.

*Conspectus generum.*

*A. Pauciflorae.* Spiculae 1-3—florae; flosculi hermaphroditi v. *diclines*.

1. *HYPOLYTRUM*: Spicae corymbosae; spiculae 3—florae; fl. masc. 2-3; flosc. femin. nudus, centralis; stylus bifidus; achenia ossea.

*B. Multiflorae.* Spiculae 6—multiflorae; flosculi *diclines*.

\* *Achenia ossea.*

2. *THORACOSTACHYUM*: Spicae corymbosae; spiculae circiter 6-florae; flosc. exteriores masculi, sequentes ad squamulas reducti; flosculus centralis femineus, nudus; stylus trifidus.

3. *LEPIRONIA*: Spica solitaria, sub apice culmi lateralis; spiculae multiflorae; flosc. masc. 1—6, vario modo inter squamulas vacuas dispositi; flosc. centralis nudus; stylus bifidus.

\* \* *Achenia drupacea.*

4. *PANDANOPHYLLUM*: Spicae capitatae, v. rarius solitariae, terminales; spiculae 6-8—florae; flosc. 3 exteriores masculi, sequentes ad squamulas reducti; flosc. femineus excentricus, squamulatus; stylus 2-3—fidus; achenia acuminata, non stipitata.

5. *CEPHALOSCIRPUS*: Spicae capitatae; spiculae circiter 7-10—florae; flosculi 3 exteriores saepius masculi, sequentes ad squamulas reducti; flosc. femineus excentricus squamulatus et squamulam vacuum amplectens; achenia longe rostrata et longiuscule stipitata.

6. *SCIRPODENDRON*: Spicae compacto-paniculatae; spiculae 8-10—florae; floscul. centralis femineus nudus; fl. reliqui omnes masculi; stylus bi—(v. tri?) fidus; achenium majusculum, sulcato—6 costatum.

I.—*HYPOLYTRUM*, *Rich.*

Spicae laxae vel compacto-corymbosae, teretes. Squamae arcte imbricatae, dein deciduae, inferiorum nonnullae vacuae, reliquae triflorae, androgynae. Flosc. masc. 2—3, monandri, uni-squamulati; squamulae squamâ oppositâ breviores, carinato-compressae; flosc. femin. nudus, centralis; ovarium oblongum v. sublagenaeforme; stylus bifidus. Achenium styli basi conicâ spongiosâ rostratum,

compressiuscule ovatum.—*Herbae perennes, rhizomate obliquo ramoso lignescente, foliis trifarie equitantibus, frequentius trinerviis, basi complicatis, culmis trigonis paucifoliatis, foliis culmeis ochreaeforme vaginantibus, corymbis squamosis, spicis parvis v. pusillis.*

1. **H. latifolium**, *L. C. Rich. in Pers. Syn.* I. 70; *Kth. Enum.* II. *Fl.* 1; *Steud., Cyper.* 132; *Miq. Fl. Ind. Bat.* III. 333; *Bth. Fl. Hongk.* 389; *Kurz in Tydsch. Nat. Vereen. Ned. Ind. deel XVIII.* 164; *ejusd. in Bot. Ztg.* 1865. 204.—Folia lato-lineararia v. linearia, sursum margine costâque apicem versus serrulato-scabra, trinervia, nervis lateralibus 2 crassis in pagina superiore obtuse prominentibus; culmi paucifoliati; corymbus amplus, intricato-ramosus, v. (in var.) simpliciuscule ramosus, contractus; achenia vix nitentia, in sicco lacunoso-rugosa v. sublaevia.

Rhizoma crassum, ramosum. Folia subcoriacea v. chartacea, trifarie equitantia, lato-lineararia v. linearia, flaccida, basin versus parum angustata, complicata, superne explanata, plicato-trinervia, margine a medio costâque subtus apicem versus serrulato-scabra, 2—2½ ped. longa, 1½—½ poll. lata. Culmi penn. gallin. crassi v. graciles, strictiusculi v. debiles, trigoni, laeves, glaucescentes, pauci—1—2 foliati. Folia culmea basi ochreaeforme invaginantia, fol. superius corymbo saepe valde approximatum et potius involucreo adnumerandum. Corymbus confertiusculus v. divaricatus, nunc simpliciuscule nunc intricate ramosus, squarrosus, involucreatus. Involucri phylla solitaria, semiverticillos ramorum sustinentia, sursum decrescentim minora et in bracteas transeuntia. Rami ancipites, laeves, v. acie scabriusculi, basi bulboso incrassati; inferiores terni rarius quaterni, semiverticillati, 1½—2 poll. longi, v. abbreviati basi unibracteati, superiores bini v. solitarii, basi bracteati; ramuli ½ poll. longi, bibracteolati, apice 4—2 spiculas gerentes v. iterato ramulosi et bispiculati, basi vix incrassata ochreaeformibracteolati. Ramorum bracteae membranaceae, marginibus chartaceis ochreaeformi-vaginatae, 2—3 lin. longae, v. in ramulis superioribus bractea inferior carinato-lanceolata acuminata, viridis, bracteolâ superiore obtusâ duplo longior. Spicae minimae, elliptico-oblongae, obtusiusculae v. acutiusculae, castaneae, nitentes. Squamae ovals, obtusae, infimarum nonnullae vacuae, reliquae 3—florae. Flosculi laterales masculi, monandri, antheris inclusis, uni-squamulati; squa-

mulae carinato-compressae squamâ multo breviores; flosc. centralis nudus, femineus, cum flosculis masculis quasi flosculum bisquamulatum hermaphroditum representans. Ovarium sublagenaeforme, glabrum; stylus breviusculus, bifidus, ramis crassis exsertis. Achenium parvum, in sicco frequentius rugoso-lacunulosum, nitidum v. sub-canescens.

HAB.—In hill forests, from Ceylon through Hindoostan to Birma, Malacca, and the Indian Archipelago, also occurring in the Philippines, Tropical Africa, Mauritius, Fidji islands.

NATIVE NAMES: Harassas lakakki, Sund., according Hassk.; ielat, Mal., but the same name is applied by the Malays to many other CYPERACEÆ.

This would appear a very variable plant, judging from Bentham's identification of *H. latifolium* with *H. trinerve*. I myself have not met with the intermediate forms, and I accept here their identity merely on the authority of that distinguished botanist who, no doubt, had a more complete series to compare than I have at present at my disposal. The varieties might be distinguished as follows:—

Var. *a. genuinum*,—spicae duplo majores, circ. 2 lin. longae, fructigeræ, ovales, fusco-canescens; achenia oblonga, crasse rostrata praesertim rostro canescente puberulae.—*H. latifolium*, *L. C. Rich.*, l. c.; *H. Mauritianum*, *N. E. in Linn. IX.* 288; *Kth. Enum. II.* 272; *H. giganteum*, *Wall. Cat.* 3404; *N. E. in Linn. IX.* 288; *ejusd. in Wight Contr.* 93; *H. diandrum*, *Dietr. Spec. II.* 365; *Albikia scirpoides*, *Prsl. Reliq. Haenk. I.* 185, t. 35; *Tunga diandra*, *Rxb. Fl. Ind. I.* 184; *Hypaelyptum nemorum*, *P. d. B. Fl. d' Oware*, II. 13 t. 67; *H. ensifolium*, *Willd. herb.* 1450; *Schoenus nemorum*, *Vhl. Symb. III.* 8. (*Rheede XII.* t. 58) *ejusd. Enum. II.* 227.

HAB.—Sumatra; Singapore: *T. Anderson*, No. 204; South Andaman; Birma, Moulmein and Amherst: *Wall. Cat.* 3404; Penang on the hills (rompot ayam incol.): *Wall. Cat.* 3404; Silhet: *Wall. Cat.* 3404; Malay Peninsula: *Griff.* 6271; Fidji islands: *Seemann*.

Var. *β. trinerve*, spicae minores, fructigeræ globosae, fuscescentes; achenia laevia, in sicco magis minusve lacunoso-rugata, nitentes, fuscescentes.—*Hypolytrum trinervium*, *Kth. En. II.* 272; *Steud. Cyp.* 132; *Miq. Fl. Ind. Bat. III.* 332; *Kurz in Tydsch. Natuurk.*

*Vereen. Ned. Ind. deel. XVIII.* 164; *ejusd. in Bot. Ztg.* 1865, 204; *Albikia schoenoides*, *Prsl. in Reliq. Haenk.* I. 185, t. 34? *Hypolytrum schoenoides*, *N. E. in Linn.* IX. 283; *Scirpus anomalus*, *Retz. Obs.* V. 15; *Hypolytrum myrianthum*, *Miq. Fl. Ind. Bot.* III. 333.

*Sub-var. 1, contracta*;—folia ultra poll. lata; culmi penn. gall. crassi; corymbi (praecipue fructigeri) contracti, ramosissima ramis inferioribus plerumque quaternatis.—Western Java; Sumatra, in Priaman: Diepenhorst (paro-paro inc.; *Herb. Bogor.* No. 2888.)

*Sub-var. 2, diffusa*;—folia ultra poll. lata, culmi penn. gall. crassi; corymbi divaricato-squarrosi, ramosissimi, ramis inferioribus ternatis. Rather frequent in the hill forests of Western Java, as on the Salak and Pangerango.

It is often difficult to distinguish Sub-var. 1 and 2 from each other, as there are many transgressions.

*Sub-var. 3, gracilis*;—folia vix. poll. lata, 3—3½ ped. longa; culmi graciles; corymbi divaricato-squarrosi, ramosi, ramis inferioribus ternatis.—This form is cultivated in the Botanic gardens, Buitenzorg, and most probably has come from the hill forests of the Pangerango or Salak. It is especially marked by the narrow leaves and the slender habit.

*Var. γ minor*, folia angustissima, ½ poll. lata v. angustiora; culmi graciles; corymbi parvi, ramis abbreviatis vix ramosis; acheniis ut in var. β.

Andamans, on Termoklee island; Ceylon: Thwaites, 3468.

2. **H. Borneense**, *Kurz.*—Folia anguste linearia, apicem versus serrulato-scabra, sub-plana, nervis 2 lateralibus in pagina superiore impressis, subtus acute prominentibus; culmi nudi; corymbus parvulus, squarrosus, ramis vix ramosis; achaenia laevissima, nitida, bisulcata.

Rhizoma stoloniferum, horizontaliter repens, squamatum, radices crassas demittens. Folia sub-coriacea, trifarie equitantia, e basi sensim angustata linearia, acuminatissima, trinervia, nervis omnibus subtus acute prominentibus, supra autem immersis, marginibus costaque subtus apicem versus spinuloso-scabra, 1—1½ pedalia, 6—8 lin. lata. Culmi foliis longiores, trigoni, nudi, laevissimi; corymbus vix pollicaris in diametro, contractiusculus, basi phyllis 1—2 culmo ipso triplo longioribus sustentus; spicae fructigerae subglobosae, iis *H. latifo-*

*liae*, var.  $\beta$ . *trinervis*, *simillima*; *achenia nitida*, *ovata*, *atrofusca*, *acuminata*, in *sicco bisulcata*.

HAB.—Borneo, Labuan: *Barber*, No. 193.

This species, in general appearance, resembles *H. latifolium*  $\gamma$ . *minor*, but may be readily distinguished by the nervature and the bisulcate achenes.

(3.) **H. Longirostre**, *Thw. Enum. Pl. Zeyl.* 346.

HAB.—Ceylon: *Thwaites*, No. 3468.

#### SPECIES DUBIA.

*Hypolytrum compactum*, *N. E., in Linn.* IX. 280; *Kth. Enum.* II. 272; *Steud. Cyp.* 32; *Miq., Fl. Ind. Bat.* III. 333.

A Luzon species which by Steudel, and subsequent authors, is compared with *Pandanophyllum humile*, Hassk.

#### II. THORACOSTACHYUM.

Kurz in Tydsch. Nat. Vereen. Ned. Ind., deel. XXVII. (nomen nudum).

Spicae corymbosae, teretes. Squamae undique imbricatae, dein deciduae, inferiorum nonnullae vacuae, reliquae spiculam 6—7 florum androgynam foventes. Flosculi 3 exteriores masculi, sequentes ad squamulas reducti; flosculus summus femineus, uni-squamulatus. Squamulae squamâ communi breviores et oppositae, carinato-compressae. Ovarium compresso-oblongum, utrinque attenuatum; stylus trifidus. Achenium osseum, lenticulari-compressum, utrinque attenuatum, rostratum.—*Herbae habitu et vegetatione omnino Hypolytri, sed spicis multo majoribus rigide squamatis insignes.*

1. **Th. Sumatranum**, *Kurz*. Folia linearia, plicato-3-nervia, spinuloso-serrulata; culmi foliis longiores, trigoni, oligophylli; corymbus polystachyus, involucratus, divaricato-squarrosus; spicae obov-oido-ellipticae, parvulae, in sicco stramineae; achenia lenticulari-compressa, utrinque attenuata, rostrata, laevia.—*Lepironia Sumatrana*, *Miq., Suppl. Fl. Sumatra*, 604.

Rhizoma abbreviatum, verticale, radices crassas demittens. Folia firma, densa, trifarie equitantia, linearia, acuminata, plicato-trinervia, margine costâque subtus a medio spinuloso-serrulata, 2—2½ ped. longa, ¼ poll. lata. Culmi folia longitudine superantes, 3—3½ ped. longi, trigoni, striati, glabri, basi paucifoliati. Corymbus polystachyus, divaricato-squarrosus, ramis brevibus triquetris; rami inferi-

ores foliis fere 1—3 ped. longis involuerantibus sustenti, reliqui sensim minora et in bracteas abeuntia. Spiculae 2—5 nae, aggregatae, oblongo-ovatae v. obovoideo-ellipticae, acutiusculae, majusculae, niten-tes, in sicco stramineae. Squamae cartilagineo-rigidae, convexiusculae, sursum deorsumque minores, elliptico-oblongae, obtusae; infimae 4—5 vacuae saepe acutiusculae; sequentes spiculam 7-floram androgynam includentes. Flosculi 3 exteriores masculi, monandri, sequentes 2 neutri ad squamulas reducti; flosc. intimus excentricus, femineus, uni-squamulatus, squamulam septimam sterilem amplectens. Squamulae laterales 2 compresso-naviculares, in carinâ ciliolatae, reliquae depressae. Ovarium e basi constrictâ compresso-oblongum, acuminatum; stylus brevis, cum ovario continuus, trifidus, ramis elongatis exsertis. Achenium compresso-lenticulare, utrinque attenuatum, styli basi persistente acuminato-rostratum.

HAB.—Sumatra, in the forests of the Lampong district, near Ipil, Battang lekko: *Teysmann* (H. Bogor. No. 3932).

NATIVE NAMES: Selingsieng (inc. Lampongensium).

2. **Th. Bancanum**, *Kurz, in Tydsch. Nat. Vereenig. Ned. Ind. XXVII. 286*; *ejusd, in Bot. Ztg. 1865. 204*. Folia elongato-linear-aria, spinuloso-serrulata; culmi trigoni, aphylli; corymbus involu-cratus, contractus; spicae breviores, ellipsoideae, obtusae, pauci spi-culatae, in sicco griseae; achaenia ellipsoideo-trigona, convexa, apiculata.—*Lepironia Bancana, Miq. Suppl. Fl. v. Sumatra, 604*.

“Caulis subnullus; folia densa, trifarie equitantia, elongata, line-aria, marginibus carinâque spinuloso-serrulata; culmus trigonus, aphyllus, angulis versus apicem scabris; involucrium inaequaliter 2-4—phyllum; corymbus contractus, ramis 6—10—stachyis, pedicellis ad angulos serrulato-scabris geminis ternis pluribusve confertis; spiculae ellipsoideae, obtusae, squamis infimis vacuis subacutis, reliquis ovali-bus obtusis striulatis griseis cum levi rubore (sub anthesi); squamulae interiores 6 (?), quarum exteriores naviculari-compressae, carinâ ciliatae; achaenia in singulâ spiculâ circiter 4, reliquis suppressis, ellipsoideo-trigona, faciebus convexis, sulco interjecto separatis, unâ majore, 2 aequalibus minoribus, crasso-crustacea, styli basi apiculata, (Miq. l. c.)

HAB. Banca, especially on river banks and in swampy places of the forests; Singapore, near swamps: *Wall. Cat. 3401*.

## III. LEPIRONIA, L. C. RICH.

Spicae solitariae, infra culmi apice laterales, teretes, multi-spiculatae. Squamae spiraliter arcte imbricatae, deciduae, inferiorum nonnullae vacuae, sequentium paucae passim squamulas steriles plurimas cum flosculo femineo includentes, reliquae multiflorae, androgynae. Flosculi masculi monandri 1—6, vario modo interpositi, uni-squamulati, reliqui ad squamulas reducti; flosculus femineus centralis, nudus. Squamulae carinato-naviculares. Antherae spurie 4-loculares, mucronatae. Ovarium sublagenaeforme; stylus bifidus. Achaenium lenticulare, compressum, obovatum, styli basi persistente rostratum, osseum.—*Herba perennis aphylla habitu Juncorum, rhizomate vage repente squamato, culmis teretibus basi vaginatis, spicis indole Scirporum quorundam.*

1. **L. mucronata**, L. C. Rich. in *Pers. Syn.* I. 170; A. Rich. in *Dietr. Class.* 297; Kth., *Enum.* II. 366; Miq., *Fl. Ind. Bat.* III. 346; Steud., *Glum.* I. 181.—Scirpus coniferus, Poir., *Encycl.* 756; *Suppl.* V. 90; Restio articulatus, Retz., *Obs.* IV. 15; Chondrachne articulata, R. Br., *Prod.* 220.

HAB.: Indian Archipelago, Sumatra in Lampongs: *Teyss.* Hb. Bog. 4249; isl. Banca; Borneo, Banjermassing: *Motley*, Hb. 1267, Singapore.

DISTRIB. New Holland; Madagascar.

NATIVE NAMES: Tikoooh in *Lamp.*; Pooron in *Banca*.

Planta elegans, 2—3 ped. alta et altior, vegetatione Juncis accedens. Rhizoma vage repens, hypogaeum, radices crassas perplurimas emittens, squamis chartaceis testaceis v. brunnescentibus striatis obtectum. Culmi pennae scriptoriae crassitudinis v. crassiores, atrovirides, striati, intus transverse septati, in sicco ad septa nodosi, aphylli, basi pauci-vaginati. Vaginae striatae, marginibus membranaceis, mucronatae, culmo magis minusve concolores, basin versus fusco-purpurascens, infimae 1—2 ovatae v. ovato-lanceolatae e rhizomate orientes; sequentes magis elongatae amplexantes; suprema usque semipedalis, caeteras longitudine multo excedens. Spica solitaria, lateralis, elliptico-ovalis v. oblonga, obtusiuscula v. acutiuscula, multiflora, basi culmi processu dilatato versus apicem terete spurie bracteata. Rhachis elongato-conica, confertissime et spiraliter cicatrifera, sublignea, intus medullosa. Squamae spiraliter dispositae, con-

fertissimae, post acheniorum maturitatem valde deciduae, inaequali lato-oblongae, obtusissimae, concaviusculae, scariosae, ad margines non raro magis minusve laceratae, fusco-ferrugineae v. badiae, apice intensius coloratae, inferiores paucissimae, vacuae, reliquae spiculam squamâ propriâ vix longiorem androgynam continentes. Spicula 12—15 flora, flosculi masc. unisquamulati, 1—6, monandri, reliqui ad squamulas reducti et sine ordine manifesta circum flosculum femin. excentricum nudum dispositi. Squamulae hyalino-albidae, apice brunnescentes, acuminatae; laterales carinato-naviculares, carinâ eleganter ciliatae: staminigeræ medianae depressae, marginibus inflexis; steriles lineari-lanceolatae, planae. Antherae dein exsertae, spurie 4-loculares, lineares, atropurpureae, mucrone albo terminatae, loculis longitudinaliter dehiscentibus, filamenta pilosiuscula, glabrescentia. Pollinia, irregulari-ovalia, sulfurea. Ovarium compresso-ellipticum uni-ovulatum, ovulo erecto, glabrum; stylus bifidus. Achaenia plano-convexa, oblonga, utrinque attenuata, marginata, striata, nitentia, testacea, stylo persistente rostellata; rostrum dimidium fere longitudinis achaenii ipsius attingens introisum curvatum.

#### IV. PANDANOPHYLLUM, HASSK.

Spicae solitariae v. capitato-compactae, teretiusculae, magnae, multispiculatae. Squamae undique imbricatae, dein laceratae et emarescente-persistentes; inferiorum plures vacuae, reliquae spiculam 5—8-floram androgynam squamâ ipsâ paullo longiores v. breviores gerentes. Flosculi exteriores 3 masculi, monandri, uni-squamulati; sequentes 2—4 steriles squamulis totitem representati; flosculus femineus excentricus unisquamulatus saepius squamulam sequentem vacuum amplectens. Squamulae laterales carinato-compressae, naviculares, squamae contrarie insertae. Ovarium sublagenaeforme v. oblongum; stylus 2—3 bifidus. Achaenium obovatum, styli basi persistente rostratum, utrinque attenuatum, pericarpio carnescente indutum, nucleo lapideo, hilo excavato.—*Herbae perennes, habitu omnino Pandanorum, rhizomate lignescente; foliis trifariis basi complicatis sessilibus v. petiolatis trinerviis; culmis trigonis, e stolonibus abbreviatis squamatis ortis, nudis v. squamatis; spicis solitariis v. capitatis, basi involucreis v. subnudis.*

1. **P. palustre**, Hassk. *Cat. Bog.* 297; *ejusd. Tydsch. Nat. Vereen.* X. 118; *Steud. Glum.* I. 134; *Zoll. Cat.* 61; *Walp. Ann.*

I. 753; *Miq. Fl. Ind. Bat.* III. 334.—Folia lato-linear, acuminatissima, trinervia, margine costâque spinuloso-serrulata, rigide coriacea; culmi 1—1½ pedalia, aphylli, obtuse trigoni; capitulum oligo-v. polystachyum, compactum, magnum, phyllis 3—4 latis squamaeformibus eo ipso brevioribus v. aequilongis involucreto; squamae lanceolatae, obtusae v. apice dilaceratae, sub-enerviae, chartaceae; achaenia inaequali-oblonga, styli basi acuminata.

VAR. *α. Malesica*, capitulis saepe pugni infantis magnitudine, hemisphaericis v. subglobosis, polystachyis; spicis autem duplo v. triplo minoribus.

VAR. *β. Silhetana*, capitulis irregulari oblongis, e 3—9 spicis maximis compositis.

HAB.—In damp hill forests in Western Java frequent, as on Pangerango, 3—4000'; on the Salak 4—5000'; var. *β*, between rocks and tree stumps, Passir Madang, Probakti, 2—4000'; Zollinger. Singapore: *Wall.* 3541 (young inflorescence); Silhet: *Wall. Cat.* 4474 (var. *β*).

NATIVE NAMES: Bangkonoh or Harassas tjae in Java.

Rhizoma crassum, obliquum, radices crassas demittens. Folia rigide coriacea, trifarie equitantia, lato-linear, acuminatissima, trinervia, marginibus rectangulariter deviis spinuloso-serrata, subtus in carinâ basi retrorse scabra, apicem versus spinuloso-serrulata, 6—9 ped. longa, 1½—2 poll. lata, supra atroviridia, nitida, subtus glaucescenti viridia. Culmi 1—1½ pedales, deorsum sensim attenuati, obtuse trigoni, basin versus subteretes, glaucescenti-virides, glabri, sublente albido-punctati. Spicae plurimae elliptico—v. conico-oblongae, ½—1 pollicem paene longae, capitato-conglomeratae, involucreto; involucri phylla 3—4 v. 6—8, squamaeformia, coriacea, e basi latissimâ oblongo-ovalia, acutata, planiuscula v. concaviuscula, spicularum longitudine aequalia v. vix longiora. Squamae lato-lanceolatae v. lanceolatae, apice obtusae v. saepius dilaceratae, sub-enerviae, laeves, chartaceae, e flavescence brunnescentes; inferiorum nonnullae vacuae; sequentes spiculam squamâ breviorē 6-floram androgynam includentes. Flosculi omnes uni-squamulati; exteriores 3 monandri, interiores 2 ad squamulas reducti, flosculus intimus excentricus femineus. Squamulae laterales compresso-naviculares, carinâ ciliatae; squamula flosculi femin. linearis, sub-plana, marginibus inflexis. Antherae exsertae, biloculares,

ab ovario aversae. Ovarium sublagenaeforme, glabrum; stylus longiusculus. bifidus. Achaenium inaequali-oblongum, utrinque attenuatum, obsolete trigonum, styli basi persistente acuminatum, pericarpio tenui carnescente testaceo, nucleo lapideo nigro.

2. **P. squamatum**, Kurz.—Folia lato-linear, acuminatissima, trinervia, margine costâque spinuloso-serrulata, rigide coriacea; culmi abbreviati,  $\frac{1}{2}$ — $1\frac{1}{2}$ —pollicares, squamati, trigoni, obscuri; capitula oligo-rarius mono-stachya, compacta, oblonga; squamae ellipticae, obtusae v. apice laceratae, in sicco striatae, chartaceae; achaenia utrinque attenuata, bicarinata, rostrata.

HAB. Java, in hilly parts of Buitenzorg: *Zippelius* (in *Hb. Bogor.*)

Rhizoma lignescens, verticale v. obliquum, radices crassas demittens. Folia trifarie equitantia, e basi complicatâ lato-linear, acuminatissima, trinervia, lateribus deviis margine subtusque in costâ apicem versus spinuloso-serrulata, coriacea, 5—6 ped. longa,  $1-1\frac{1}{4}$  poll. lata. Culmi e foliorum axillis erumpentes, abbreviati,  $\frac{1}{2}$ — $1\frac{1}{2}$  poll. longi, undique, praesertim basi, squamis ovato-oblongis concavis acutis striatis obtekti, trigoni, striati, glabri. Spicae 2—3, capitato-conglomeratae, rarissime solitariae, oblongae, obtusae. Squamae undique imbricatae, ellipticae, obtusae v. saepius lacerantes, in sicco striulatae, fuscescentes, inferiores 4—5 vacuae saepe involucrantes, reliquae spiculam 6-florâ squamâ propriâ paullo longiorem androgynam continentes. Flosculi 3 exteriores masculi, monandri, sequentes ad squamulas reducti, flosculus intimus excentricus femineus squamulam vacuum amplexens. Squamulae laterales lineares, curvati, carinato-naviculares, in carinis minute denticulatae. Achaenium adhuc (immaturum) oblongum, utrinque acuminatum, bicarinatum, pericarpio tenui coriaceo, nucleo lapideo cinerascens apiculato.

3. **P. Zeylanicum**, *Thw. Enum. Pl. Ceyl.* 345.

HAB. Ceylon: *Thwaites*, *C. P.* 3029; South Andamans.

This species, which is not yet recorded from the Indian Archipelago, differs from the next one, *P. Miquelianum*, especially by the more robust and obtuse spikelets, which form a head, when fully grown, not dissimilar to that of *P. palustre*. The scales are furnished by a broader white (in dried state brown) margin. Dr. Thwaites describes his plant as having a clavate style, but the Andaman specimens have them normally two cleft. I saw the Ceylon

plant in the Herbarium of the Botanic gardens at Buitenzorg, but unfortunately I have here no specimen to examine. I strongly suspect that Dr. Thwaites, when describing the plant, has had before him young spikelets only.

4. **P. Miquelianum**, *Kurz*. Folia elongato-linearia, acuminatissima, trinervia, margine costâque spinuloso-serrulata, flaccida, utrinque nitentia, saturate v. flavescente viridia; culmi elongati,  $1\frac{1}{2}$ —3 pedales, nudi, trigoni, nitentes; spicae solitariae, squamis laete viridibus anguste albide (in sicco fusciscente) marginatis; achenia oblonga, utrinque attenuata, acuminata, vix carinata.—*Lepironia enodis*, Miq., Suppl. Fl. v. Sumatra, 603; *Lepir. foliosa*, Miq. l. c. (*spicis adhuc virgineis*.)

HAB. Sumatra, in the jungles of Danoh-tjaloh, Moesi, Palembang: *Teysm. Hb. Bog.* 3686 et 4051.

NATIVE NAME: Rumpul selingsieng in Palembang.

Rhizoma crassum, obliquum v. subverticale, lignescens, radices plurimas crassas demittens. Folia trifarie-equantia, lato-, v. angustelinearia, acuminatissima, infra medio paullo angustata, complicata, basi vix dilatata, 4—5 ped. longa,  $\frac{1}{3}$ —1 poll. lata, margine versus basin et apicem, v. totâ longitudine, remotiuscule spinuloso-serrulata, costâ apicem versus spinulosa, trinervia, marginibus rectangulariter deviis. Culmi e rhizomate stolonibus abbreviatis squamatis orientes,  $1\frac{1}{2}$ — $3\frac{1}{2}$  ped. long., sursum sensim incrassti, obtuse trigoni, striulati, nitentes. Spicae terminales, solitariae, conico-ellipticae v. clavato-oblongae, obtusae, dein acuminatae. Squamae undique arcte imbricatae, emarcescente persistentes, sursum sensim minores, oblongo-lanceolatae v. lato-oblongae, acutatae; superiores obtusiusculae, virides, margine anguste membranaceo albidae (in sicco autem fusciscentes), sub-trinerviae, nervis tenerioribus parallelis percursae; inferiores 9—10 vacuae, sequentes 5—florac. Flosculi omnes unisexuales, exteriores 3 masculi, monandri, intimus femineus squamulam sterilem amplectens. Squamulae flosculorum exteriorum compresso-naviculares, carinâ erose-ciliolatae, medianae depresso-bicarinatae, in angulis ciliolatae. Filamenta dein elongata paullo supra squamulam exserta; antherae lineares filamento dimidio breviores, biloculares, longitudinaliter dehiscentes, flavescendo-albidae, apice minute apiculatae. Flosculi feminei excentrici, squamula depressa, linearis, marginibus inflexis

squamulam sterilem amplexens. Ovarium sublagenaeforme laeve; stylus breviusculus, ovario continuus, emarcescente persistens, trifidus, ramis inclusis. Achaenium obovatum, basi angustatum, apice styli basi persistente acuminatum, pericarpio tenue carnosulo (in sicco coriaceo) laevi testaceo, nucleo lapideo nigrescente.

Prof. Miquel, in establishing his *Lepironia enodis* had only the full-grown inflorescences before him, which were distributed from the Botanic gardens, Buitenzorg, under No. 3029, and described therefore the plant as having no leaves. But the leaves with young inflorescences were (by mistake probably) distributed at the same time under No. 4051, coming also from Palembang, and upon these specimens he founded his *Lepironia foliosa*.

5. **P. Humile**, Hassk., *Cat. Bog.*, 297; *Steud.*, *Cyp.* 134; *Zoll.*, *Cat.* 61; *Walp.*, *Ann.* I, 753; *Miq.*, *Fl. Ind. Bat.* III, 334; *Oudem.*, in *Bot. Ztg.* 1866, 193.—Folia petiolata, laminâ elongato-ellipticâ retusâ abrupte subulato-cuspidata, marginibus apicem versus spinuloso-serrulatâ; petioli complicati, basi vaginato-dilatati; culmi plerumque geminati, elongati v. abbreviati, basi squamato-vaginati; spicae solitariae (rarius binae), squamis fuscescente viridibus plurinerviis; achenia oblonga utrinque attenuata, acuminata, obsolete bicarinata.—*Lepistachya praemorsa*, *Zipp. M. S.*; *Lepironia cuspidata*, *Miq. Suppl. Fl. v. Sumatra*, 603; *Pandanophyllum Zippelianum*, *Kurz in naturw. Tydsch. v. Ned. Ind.* XXVII. 126; *ejusd. Bot. Ztg.* 1865 204.

HAB.: One of the most common grasses in the hill forests of Western Java, at 3-5000' ft. elevation; occurs also in Banca: *Teysmann*; and in Sumatra: *Korthals*.

NATIVE NAME: Sohlenat, Sunda.

Rhizoma crassum, obliquum v. verticale, lignescens, radices plurimas demittens. Folia trifarie equitantia, subcoriacea, petiolata; lamina elongato-elliptica, 1—1½ ped. longa, 1½—2½ poll. lata, basi in petiolum complicatum longitudine ab 1—2½ poll. variantem basi vaginato-dilatatum decurrens, apice retuso abrupte subulato—(—2 poll.) cuspidata, plicata, 3—nervis, margine apicem versus costâque spinuloso-serrulata. Culmi e stolonibus abbreviatis squamato-vaginati plerumque geminatim orti, nudi, deorsum attenuati, obtuse trigoni, striati, glabri, 1—4 poll. usque ad pedem longi, intense virides opaci, sub lente albido-punctati. Spicae oblongae v. ovato-

oblongae, obtusiusculae v. acutiusculae, solitariae, v. passim binae. Squamae arcte imbricatae, emarcescente persistentes, sursum sensim minores; inferiores 3—4 vacuae, lanceolatae v. oblongo-lanceolatae, obtuse carinatae, striatae, opacae, virides, margine membranaceo brunnescentes; sequentes ecarinatae, nervosae, teneriores, flavescente-testaceae v. brunnescentes, nitentes, spiculam 6 florum androgynam foventes. Flosculi omnes uni-squamulati, 3 exteriores masculi, monandri; 2 interiores ad valvulas reducti: flosc. intimus excentricus, femineus. Squamulae flosculorum laterali compresso-naviculares, in carinis eroso-ciliolatae, medianae depressae. Antherae exsertae. Ovarium sub-lagenaeforme, laeve; stylus brevis ovario continuus, emarcescente persistens, trifidus, ramis elongatis inclusis. Achaenia oblonga, styli basi apiculata, obsolete bicarinata, pericarpio carnescente (in sicco coriaceo) brunnescente asperulo, nucleo lapideo nigrescente.

This is a very variable species, not only with regard to the leaves, which are longer or shorter petioled, but also with reference to the length of the culms, sometimes attaining nearly the length of the leaves, sometimes reduced so as to let the spike appear almost sessile. Sometimes these culms are furnished also with a few bracts.

6. **P. immersum**, *Thw. Enum. Pl. Zeyl.* 433.

HAB.: Ceylon: *Thwaites C. P.* 3819.

Rhizoma crassum, lignescens, radicosum. Folia trifarie-equantia, 2—2½ pedalia, pollice angustiora, anguste linearia, acuminata, basin membranaceo-marginatum breviter vaginantem versus angustiora, complicato-trinervia, laevia, supra nitida, subtus glaucescentia et opaca, marginibus costâque basin versus remote et minute serrulata v. omnino laevia. Culmi pollicares v. breviores, bracteis sursum majoribus spicâ ipsâ solitariâ sublongioribus obtecti. Bractee culmeae superiores involucrantes, membranceo-marginatae, lineares, acuminatae. Spica fructigera cerasi minimi magnitudine, densiuscula, squamis late-ovatis acuminatis in sicco fusciscentibus striatis. Achaenia ovata, incurvato-rostrata, ecarinata; pericarpio carnosulo.

V. **CEPHALOSCIRPUS**, KURZ.

Spicae glomerato-capitatae, multi-spiculatae. Squamae undique imbricatae, emarcescente persistentes, inferiorum nonnullae vacuae, reliquae spiculigerae. Spiculae 7—10-florae, squamâ propriâ longiores. Flosculi omnes uni-squamulati, nunc 3 exteriores, nunc 3 alii masculi,

monandri, reliqui ad squamulas reducti; flosculus intimus femineus squamulam sterilem amplexens. Squamulae laterales carinato-compressae. Ovarium basi stipitiforimi-attenuatum; stylus trifidus. Achaenium longe stipitatum, rostratum, pericarpio carnosulo, nucleo lapideo.—*Herba perennis habitu omnino Pandanophyllorum, sed phyllis involucrantibus longissimis etiam adspecta diversa.*

1. **C. macrocephalus**, *Kurz.*—*Hypolytrum macrocephalum*, *Gaud. in Freyc. Jt. Bot.* 414; *Kth. En.* II. 273; *Steud., Cyp.* 133.

HAB.: Moluccos; *Gaudichaud*; ib. isl. Batjan; *Teysmann.* (in *Hb. Bog.*)

Rhizoma.....Folia.....Culmi trigoni, glabri, pedales, basi paucifoliati. Spicae semipollicares, majusculae, plurimae, inaequali-oblongae, compressiusculae, glomeratae; glomeruli phyllis singulis sustenti in capitulam involucratum pollicem dein  $1\frac{1}{2}$  poll. crassum compacti. Involucri phylla inferiora 3—4, pedalia v. longiora, poll. lata, lato-linearia, subulato trigono-acuminata, trinervia, marginibus rectangulariter deviis, margine costâque subtus apicem versus spinuloso-serrulata, subcoriacea, phylla sequentia mox in bracteas glomerulis ipsis minores lato-ovatas acuminatas transeuntia. Squamae undique imbricatae pellucescente-chartaceae, oblongo-lanceolatae, obtusiusculae, trinerviae, glabrae, nitentes; inferiorum nonnullae vacuae, reliquae spiculam 7—10—floram includentes. Spiculae lineares, compressae, squamâ longiores. Flosculus intimus excentricus femineus uni-squamulatus, squamulam sterilem amplexens; flosculi sequentes 3 v. 3 alii extimi masculi, monandri, uni-squamulati, reliqui ad squamulas vacuas reducti. Squamulae laterales compresso-naviculares, carinâ ciliatae, medianae depressae. Ovarium sublagenaeforme, utrinque angustatum, glabrum; stylus longus, persistens, trifidus, ramis elongatis. Achaenia oblonga, basi in stipitem longum gracilem attenuata, tricarinata, stylo persistente longe acuminato-rostrata (rostrum achaenium longitudine paullo superans), pericarpio carnosulo, (in sicco tenui coriaceo) glabro testaceo, nucleo lapideo nigrescente.

I have not *Gaudichaud*'s work above cited for consultation, but I think I am correct in quoting his plant from *Kunth*'s and *Steudel*'s descriptions.

## VI. SCIRPODENDRON, ZIPPELIUS.

Spicae glomerato-paniculatae, compactae, undique squamatae. Squamae emarcescente persistentes, inferiores saepius tri—superiores uni-

spiculatae, 8—10 florum, androgynae. Flosculus centralis femineus, nudus; flosculi reliqui masculi omnes monandri, uni-squamulati. Squamulae squamae contrariae; laterales compresso-naviculares; vacuae nullae (an semper?). Ovarium lagenaeforme; stylus longiusculus, bi—(an etiam tri?) fidus. Achaenium magnum, obovatum, 6, (12?) costatum, pericarpio carnoso (in sicco corticoso rugoso), nucleo lapideo mucronulato.—*Planta perennis habitu Pandanis veris acaulis ita similis, ut ab his aegre discernenda nisi inflorescentia.*

1. **Sc. costatum**, Kurz. Scirpodendron pandaniforme, Zipp. MS.; Pandanophyllum costatum, Thw. En. Pl. Zeyl. 433? Scleria macrocarpa, Wall. Cat.

HAB.—In the hill jungles of Western Java along the torrents and in swampy places: Zippelius, &c. Singapore and Penang: Wall. 3538; Ceylon: Thwaites.

NATIVE NAMES: Harassas in Sunda.

Rhizoma crassum, obliquum, lignescens. Folia coriacea, trifarie equitantia, lato-linearia, acuminatissima, 6—9 ped. longa, pollicem lata et latiora, trinervia, lateribus rectangulariter deviis, margine costâque a medio spinuloso-serrulata. Culmi 1—1½ ped. longi, trigoni v. triquetri, glabri v. in angulis scaberrimi, aphylli, basi squamati. Panicula compacta, terminalis, pauci-ramea, ramis brevibus crassis simplicibus, inferioribus 3—4 phyllis singulis sustentis involucrentibus. Involucri phylla longissima, 7—2 ped. longa, foliis subconformia. Spicae sessiles v. sub-sessiles, compositae, basi bractea magnâ chartacea e basi latâ oblongâ acutâ concavâ sustentae. Squamae oblongae, obtusiusculae, carinatae v. subcarinatae, striatae, membranaceae, inferiores saepe spiculas tres, sequentes spiculam unicam squamâ propriâ breviorē tegentes. Flosculus centralis nudus femineus. Squamulae laterales lato-carinato-naviculares, carinâ ciliolatae. Antherae exsertae. Ovarium sublagenaeforme; stylus longus, bifidus, ramis brevibus. Achaenia drupacea, magnitudine pisi majoris, in sicco sulcato—6—costata, rugosa; pericarpium in sicco corticosum; nucleus obovatus, obsolete 6—costatus, apiculatus, lapideus.

I am in doubt whether Dr. Thwaites' *Pandanophyllum costatum* is identical with this plant, as his short description does not well coincide with the above characteristic. According to that author the achenes are 6—12 ribbed, but the Malayan species which I have examined, have them all 6-ribbed only.

*The Malacology of Lower Bengal and the adjoining provinces ; by*  
FERD. STOLIĆZKA, Esq., Ph. D., F. G. S., &c., *Palæontologist of the*  
*Geological Survey of India.*

[Received and read 4th November 1868.]

Under the above title I propose to record a series of papers, the special object of which is the exposition of the Molluscan fauna of Lower Bengal and of the adjoining provinces. It is not my intention to follow in these papers any systematic arrangement, but simply to bring the materials, as they are collected, to the notice of Conchologists.

At first sight it may seem that there is hardly a necessity for a series of such papers, as the Molluscan fauna of Bengal is pretty well known through the valuable researches of H. Benson, W. T. Blanford, and others. With regard to our knowledge of the shells, or the solid parts of Molluscs, this statement would deserve a fair consideration, but it is marvellous how very ignorant we are of the soft parts of the respective animals. The course of study pursued in Conchology during the last twenty years, has shewn that no systematic arrangement can be attempted without the due knowledge of the animals, even generic and specific determinations are sometimes impossible to be carried out without them. Comparative anatomy and morphology of our Molluscs are equally deficient as the principal elements.

Strictly speaking it is by no means surprising that the anatomy of our Indian Molluscs is as yet so little known. The shells are easily preserved and more or less commonly found at all times of the year. The animals on the contrary are met with only at certain seasons characterized by a large proportion of moisture in the atmosphere, which combined with the tropical heat often rapidly decomposes the animal substance, while under the knife and the needle. Besides few of our able conchologists had had the opportunity of observing many live animals, and the examination of specimens, preserved in spirit, glycerine, &c., are very easily misleading, so as to give various organs a different interpretation from that to which they are actually destined.

During the course of my papers I shall, therefore, endeavour to pay special attention to the soft parts of the animals, to the anatomical

and morphological details. Only the shells of newly discovered species will be separately figured, but of all species, as far as they can be procured, representations of the animals, of the dentition, &c., will be given. I shall feel amply rewarded, if I can see that any of my conchological friends appreciate this course of inquiry; and I will feel greatly obliged if they would favour me with live specimens of Molluscs. During the rains and in the cold weather most of the land shells will survive for 9 and 10 days in a box with a little moistened moss, a few holes being made in the box for the purpose of ventilation. If not procurable alive, specimens in spirit or glycerine\* will be also thankfully received.

I do not wish to give my papers a more extensive title, than the one quoted above, because I as yet have only the hopes to procure those specimens which are within my own reach and that of my collectors, but I trust that the area of my research and examination will gradually obtain a wider range. The first paper will be devoted to the examination of some remarkable Molluscs, for a species of which Dr. F. Buchanan 70 years ago proposed the name *Onchidium*.† These animals may be in a certain point regarded as the tropical representatives of the slugs, or *Limaces*, which are generally found only in temperate climates. Although I have numerous materials on other groups of Molluscs collected, I have given preference to this one, because the characteristics given of the genus are very deficiently known, and partially incorrectly recorded in the present leading works on Conchology. Dr. Buchanan's description of the type species, *Onchidium typhæ*, is not very clear, neither is it sufficient, and the general belief was, that the species has been lost sight altogether. Nevertheless I find that it was very well known for many years to several of our Indian Conchologists, and it is actually during the rainy season a very common species about Calcutta.

\* Glycerine does admirably for these purposes. It is occasionally advantageous to put the animal first in hot water for a few minutes, and after its death in glycerine or spirit, the animal does not shrink afterwards so much as it would when put in glycerine alive.

† An account of the *Onchidium*, a new genus of the class of Vermes, found in Bengal, by F. Buchanan, M. D., A. L. S.;—read June 5th, 1798; Transactions Linn. Society, Vol. V., 1800, p. 132.

No. I. On the genus *ONCHIDIUM*, with descriptions of several new species; (with plates XIV and XV.)

Order.—*PULMONATA*.

Family.—*ONCHIDIIDÆ*.

Genus.—*Onchidium*, Buchanan, 1800.

*Char.* Body oblong, entirely covered by a coriaceous, more or less tuberculated mantle, projecting at the sides and internally fleshy; foot long, narrower and little shorter than the mantle; head large, distinct; the mouth situated below, forming a longitudinal slit surrounded by thickened lips, and two, more or less, prolonged and thickened buccal appendages, to the upper edge of which are, so to say, the tentacles soldered on, being represented merely by thickened rims; superior to these are the long, retractile pedicles bearing on their tips the eyes. Two cartilaginous plates in the œsophagus are covered with a broad radula furnished with very numerous, small equally formed teeth, the central tooth being pointed and equilateral, the laterals usually somewhat smaller, almost all of equal size, slightly hooked, claw-shaped; no special upper jaw is present. Anus situated at the upper basal end of the foot; pulmonary orifice posterior to it in the mantle. The sexes are united, the common sexual opening being placed more or less close to the right of the anus, in the fold between the inner side of the mantle and the foot; a special male organ is besides situated under the right eyepedicle; it is thick, long, provided with a short flagellum; the propagation is effected by mutual reciprocal impregnation. Shell none. Habit similar to that of the *Limaces*, or rather more to that of sea slugs, as I shall endeavour to prove hereafter.

Before entering upon a description of the various species, it will be necessary to give a detailed statement of the most important and characteristic anatomical and morphological points. I select for this purpose the type species of the genus; any differences in the other species from this type can be afterwards much easier recorded, without giving a repetition of those details. In conclusion I shall allude to the genera *Onchidella* and *Peronia*, which have been considered as distinct from *Onchidium*.

The upper part of the body of all the *Onchidia* is, as stated above, always entirely covered by a more or less coriaceous mantle, the epidermis of which chiefly consists of a chitinous or horny substance, and

can be removed from it without producing a change in the colour of the animal. The surface of the mantle is generally finely granulated, but in all our species some larger tubercles are besides found, more or less numerous, and irregularly distributed on it. These larger tubercles can be protruded or retracted at will. When the animal is in a healthy state, they are generally very distinct, each of them bearing one to four jet black dots, the functions of which in the economy of the animal it is difficult to understand, but most likely the pigment which they contain, when added to the mucus secreted by the entire body, acts as a kind of defensive fluid against other animals. The mantle is amply supplied with nerves issuing from the central ganglion, but to the touch, the tubercles do not appear to be much more or less sensitive than the rest of the body; they are always retracted when they come in contact with a solid object, but soon protruded again. Sickly animals not only change colour, but the body often shrinks to less than half the original size, and all the tubercles of the surface are smoothed down, and assimilated to the mass of the mantle. The mesial portions of the mantle are usually thin, but the sides are very consistent and fleshy, the muscular tissue being solid, very tough in some of the species (*O. tigrinum*), soft, almost pulpy, in others, (*O. tenerum*). The internal fleshy part of the mantle is pure white, but the external parts, to a smaller or greater thickness, blackened, and filled with pigment cells, producing the various colours of the animal. Near the edge of the mantle, there are usually some larger cavities in the tissue, as shewn in the section of the portion of the mantle (fig. 3, plate xiv), evidently allowing for an easier motion of these extreme edges.

The foot is composed of numerous transverse muscles and is always shorter and narrower than the mantle; this varies, however, in the different species. In some the foot is only one-third, or one-fourth, of the width of the mantle, in others almost four-fifths of the same, setting aside, however, those variations which merely depend upon the position of the body. When the animal is at rest,—in a sort of contracted position,—the width of the foot is in proportion smaller, than when the animal moves about, in which case the mantle stretches out longitudinally, while the narrowness of the foot appears to be more limited by the transverse muscles.

No generic importance can, strictly speaking, be attached either to

the number and size of the pustules on the mantle, nor to the relative narrowness, or width, of the foot. This is a very important statement as regards the classification of the animals, and I shall endeavour to prove its correctness by some observations which I shall subsequently put upon record.

The head is posteriorly on either side connected with the foot by a thin membrane.

#### Anatomy of *Onchidium typhæ*.

The respective places which the digestive and generative organs occupy divide, so to say, the entire cavity of the body into two parts. Figure 2 on plate xiv represents a specimen, opened along the entire length of the centre of the mantle, the portions of which are removed a little on the sides. The albuminous string of the penis is also a little lifted up, and placed from the right to the left side, so as to allow the ganglion and the penis to become visible. All the other internal organs are in their original position; the head with the œsophagus (oe), salivary glands, (sg); alimentary canal (ac), &c. The signification of the principal other letters is as follows; pe. = pedicle; *p* = penis with the *vas deferens* twisted round it; and (ps) the supplementary albuminous string; *ng* = principal nervous ganglion; the digestive organs with the liver (l) and the anterior portion of the stomach (st), rectum (r), &c., are visible; the generative organs with the ovarium (o), testis (t), large albuminous gland (ag), receptaculum seminis (rs), &c.; *ht* = heart; *l* = lungs; *g* and *v* = the hermaphrodite genital opening, *a* = anus; *ol* = pulmonary orifice. The digestive organs, thus roughly estimated, occupy the greater portion of the front part, and the generative organs that of the hinder part of the body.

In order to understand more clearly the anatomical details, I must direct the attention to figure 5 of plate xiv. This figure represents a very large specimen of *Onchidium typhæ*; the foot has been along its anterior and posterior, and the entire left basal margin detached from the body and folded over to the left side, then the mantle has been cut in two halves and the left half (d) also removed laterally, so as to join the other half only at the pulmonary orifice. The digestive organs have been exposed in the figure on the right and the generative organs on the left side.

*Digestive organs and their appendages.*

The food first enters through the mouth which, as already stated, is surrounded by thickened, soft and grooved lips, with the œsophagus (oe), a large muscular sack of an oval shape, closed posteriorly. This sack encloses two cartilaginous plates, which are situated in a strongly muscular mass, attached to the posterior and inferior sides of the œsophagus. Sometimes, as in this particular species, these plates resemble a bivalve shell, being convex externally and concave internally; they are white, connected by a membrane below and open above. Their microscopical structure distinctly shews the formation of a cartilaginous tissue, many of the cells being of irregular shape, others granular and hardened. Externally they are covered by the tongue membrane, or radula, which is provided in its entire extent with very numerous teeth.

This radula is thus very differently formed from the narrow and long lingual ribbon of the *Prosobranchia*. Fig. 4 on plate xiv, represents the relative position of these organs. The cartilaginous plates (cp) actually only give support to the radula (ra), which is by the muscular action of the former pushed out of the mouth, scraping the organic substance in the usual way from below upwards; the food then passes in the cavity behind the plates where the salivary glands (sg) enter. At the beginning of the alimentary canal, immediately behind the cartilaginous plates, there is a small fleshy tubercle (to) which appears to act as a tongue, pressing the food down the canal every time that the œsophagus contracts. Each of the salivary glands (sg) is represented by a small, whitish, dendritic organ, connected with each other by a thin string, and by numerous threads with the hepatic mass, enveloping the anterior part of the intestines. The alimentary canal issues at the upper part of the œsophagus, lying in a special muscular cavity of the tissue of the body, it bends downwards, then passes through the hole of the principal central ganglion ring (ng) to the stomach. This consists of two, almost quite separate divisions. The first portion (pst) has the form of a double cone, pointed on either end and widened in the middle; it is soft and composed of numerous folds or partitions. On this anterior portion follows a second one, which is more elongated, consisting of three sub-divisions, being in the middle surrounded and partially divided by a very strong muscular tissue (mst). The extreme end (m) is capped by a separate

portion of the liver (l). The intestines (i) issue somewhere at the muscular bridge which connects the two portions of the stomach, being from here in their entire length enveloped in the liver which is readily recognised by the greenish colour of the hepatic cells. The length of the intestines is from 4—5 inches, the rectum (r) being much wider, and passing almost in a straight direction to the anus. Near its termination it is accompanied by two whitish, dendritic organs, (gp and pa), each of which at their posterior ends is connected with a small yellowish brown gland. The latter may represent the kidneys, and the former are probably only albuminous glands, or they may be an equivalent organ of some of the pyloric appendages or the cœca. The anus is situated at the end of the upper base of the foot, it is surrounded by ring muscles, but externally very slightly thickened.

*Onchidium typhæ*, and probably most of the other species live, on decaying wood and earth, impregnated with organic matter. I have never seen them feeding on fresh grasses. With the solid excrements always a large portion of watery liquid is given out.

#### *Generative organs.*

All the species of *Onchidia* which I have examined are hermaphrodites, not as Buchanan stated in the case of *O. typhæ*, supposing the sexes to be distinct. The generative organ occupies the posterior half of the internal cavity of the body (see fig. 2, pl. xiv), sometimes even a little more. The hermaphrodite genital pore (g and v in fig. 5) lies very close to the right of the anus; in this pore a very strong, almost cartilaginous tube, the oviduct, (or here the uterus, ov) terminates, and a short distance upwards gives off a short branch, ending in a flattened large vesicle, which usually is interpreted as the *receptaculum seminis* (rs). The contents of this organ in numerous specimens which I examined was a dark yellowish brown, rather watery substance, containing some solid bodies, resembling the spiculæ of *Spongiæ*, or those peculiar arrows connected with the copulation of *Helices*. The uterus which is only a continuation of the oviduct is, as stated above a thick, white, doubly twisted string, near the middle it is partially enveloped in a mucus secreting, foliated, pale orange gland (as in fig. 2, pl. xiv.)\* The contents of this gland is a simple granular

\* In figure 5 this gland lies to the right of the testis (t) and to the left of the receptaculum seminis (rs).

substance. It is not clear to what purpose it exists, but probably it is in some way connected with the ovarium or the testis.

The ovarium (as, in fig. 5, or in fig. 2) is of a deep yellowish colour and contains eggs only; these being of an oval form and of various sizes, according to their stages of development; the whole is attached to the uterus by a short string.—It is generally stated that in the PULMONATA, the hermaphrodite gland secretes ova and spermatozoa, but in this case I am certain that they are secreted in two different glands, the ovarium containing, as I stated, merely eggs. The testis (t) is a distinct foliated, or more or less dendritic, purely white gland, which is readily distinguished by its viscous, jelly-like substance. Under the microscope, the contents of the gland had a granular appearance, mingled with a few fat cells, and numerous long thread-like bodies,—spermatozoa. From the testis a very thin hollow string issues, accompanying the oviduct in its entire length and terminating by a special minute pore (g) in the same cavity as the oviduct. This string is evidently the beginning of the *vas deferens*, which continues externally in a groove between the foot and the mantle.

The largest portion of the generative organs are occupied by the albuminous gland (ag) which is of a soft purplish colour, consisting of very numerous follicles attached to short prolongations of the uterus. The albuminous substance has a finely granular appearance under the microscope and is very viscous, adhering to everything that comes in contact with it. It absorbs water to a large proportion swelling up readily in it.

The male copulative organ is at the front end of the body, situated more or less closely to and under the right eye-pedicle. The semen issues, as stated above, first from the genital pore (g), is then conducted in an open canal along the right side between the foot and the mantle, enters the body through a very fine pore (vdo in fig. 5), below, or on the side of, the right buccal appendage, close to the penis opening; then passes through a thin long tube (vd) which is variously twisted round the penis (p) lying on the right side of the body. This tube, the continuation of the *vas deferens* is about 5 inches long, the last inch, or so, forming the penis, which is considerably hardened and straight, situated in a somewhat wider tube and provided at its termination with a short flagellum. In many

specimens the *vas deferens* was in the terminal half of its length filled with a similar colouring fluid which I have noticed in the *receptaculum seminis*; thus it is not likely that this substance is secreted in the latter organ, but more likely is formed in the internal portion of the *vas deferens*. Close to the opening of the male genital pore, terminates the supplementary albuminous string (ps), varying from 9 to 10 inches in length. It is much thicker than the *vas deferens* and the contents is a purely white granular, moderately viscous substance. In some other species, this albuminous string is still longer and more developed.

I have only once (on the 22nd September,) observed two specimens of *Onchidium typhæ* in copulation, they were seated one behind the other, the penis enclosed in the vagina for about the length of one inch. Reciprocal impregnation at the same time, as known in *Limaces*, does apparently not take place. Buchanan's statement on this point is not clear; the error as to his believing the sexes to be divided in two animals is thus readily explained, and would have then been easily corrected, had he examined the internal organisation. But although he states that "during copulation the distinction of sexes is very evident, the penis protruding to a great length," it would appear from his previous statement to the effect that "in both, the anus and sexual organs are placed in a perforation in the under part of the tail" as if he had observed that the copulative organ were also situated posteriorly. This is undoubtedly an error, and can only be explained by the fact that the anterior and posterior end were mistaken one for the other, they being actually undistinguishable in a dorsal view when the animal is resting quietly, and has the pedicles and the head retracted, which position it actually assumes during copulation. I mention this point in particular, because it appears to have been accepted by several authors in its integrity, as recorded by Buchanan, though its correctness was rightly questioned by others. Undue importance has been attached to it, so as to support the presumed generic distinctions of *Onchidium*, *Onchidella* and *Peronia*.

The *Onchidia* in general are to all appearance oviparous, laying their eggs in damp places, either under stones or in holes near the surface of the ground, where I found in large numbers very young specimens, resembling in all external characters the full grown

animals. Direct observations as to the development of the embryos, etc. remain, however, as yet a desideratum.

*Organs of respiration and circulation.* (See fig. 5, pl. xiv).

All the *Onchidia* are pulmoniferous, the respiratory cavity occupying about one-fourth of the posterior length of the body. This cavity is situated dorsally immediately under the mantle, its internal walls being folded and fitted out with a soft whitish largely cellular and cavernous epithelium, the lungs; it is anteriorly closed on the left and open on the right side, and the former half is somewhat smaller than the latter. The respiratory opening is a round hole, situated on the lower side at, or near, the end of the mantle; it is surrounded by strong concentric muscles and has occasionally a swollen margin, which can be expanded or contracted at will, sometimes also forming a retractile tube.

The cardiac cavity lies on the right side about two-fifths distant from the posterior end, and in front of the respective larger half of the lungs. It is very muscular and encloses the heart, which is represented by a small, reddish, oval capsule, thicker posteriorly than anteriorly. The arterial blood enters the heart from behind in which point,—save that they have lungs,—the ONCHIDIDÆ perfectly agree with the NUDIBRANCHIATA of the OPISTHOBRANCHIA, with which they have so much common in the general form of the body. From the heart issues in front only one thick artery, being at the beginning attached to the wall of the mantle by numerous very thin muscles. A short distance from its issue, it divides in two branches, one supplying the reproductive organs and the other the digestive system. The latter branch again divides before entering that system, one portion being reserved for the digestive organs, and the other supplying the head; this portion of the artery, accompanying the alimentary canal, passes through the large ganglion. From all the internal organs, numerous very thin threads issue, connecting them with the mantle and the foot; some of these threads are no doubt blood-vessels, and others of a muscular and nervous character. The venous blood appears to be conducted to the lungs by an open capillary system, at least I did not observe special vessels for that purpose. A very large number of capillary tubes, connects the upper frontal portion of the pulmonary cavity

with the intestinal and the generative organs. The arterial blood is white, and the corpuscles very minute and of an oval shape.

*Nervous system and organs of sensation.* (See fig. 5, pl. xiv.)

The principal ganglion which is a thick white ring, lies immediately behind the head; a portion of the aorta and the alimentary canal passing through it. This ganglion gives up numerous branches laterally to the base of the eye-pedicles, the tentacular rims and buccal appendages. One thick branch, subsequently dividing, issues below and supplies the head, some of its small nervous threads uniting into a small ganglion between the oral appendages. Another very thick branch also issues from the central ganglion below, and is directed backwards, accompanying the alimentary canal. It divides at the digestive organs in two branches, one supplying these and the other the generative organs. Besides these, there issue from the central ganglion five long threads on each side, two giving the requisite number of nerves to the foot and four (or 8 altogether) to the mantle. They appear, however, to be connected with the other nervous branches of the intestines by numerous very fine threads.

From the generic characteristic which I have previously given, it will be seen that I have made the distinction between eye-pedicles and tentacles. This verbal distinction is, I believe, in most of the Gastropods, an essential one and it is, for instance, not correct to speak in the *HELICIDÆ* of four tentacles, for they do not all serve the same purposes. Strictly speaking, there is only one pair of each, two tentacles and two pedicles. The presence of only one pair of tentacles,—actually the eye-pedicles,—has been pronounced as a peculiarity of the *Onchidia* and was used as an important distinction from the genus *Vaginulus*. The *Onchidia* possess, however, beside the pair of prolonged pedicles, a pair of true tentacles, which appear as thickened rims on the upper surface of the buccal appendages. Thus the distinction from *Vaginulus*, which has the tentacles free and bilobed, is in this point only a gradual one of development.

When the mantle of an *Onchidium* is dorsally cut open, and the internal organs exposed, the dark pedicles are seen to be attached laterally to the mantle, reaching with their bases beyond the head

(see *pe* in fig. 5, pl. xiv ; and the figure between 1 and 1 a). The base of each is flattened, white, cartilaginous, intimately connected with the muscular tissue of the mantle in this place ; above the base numerous nerves enter to it, and the trunk of the pedicle becomes hollow, more cylindrical and soft. The small, black eye is situated eccentrically near the tip, which is pointed, angularly bent and attached by a strong muscle to the internal side of the outer skin (*tp*, in fig. 5) of each pedicle. The muscle then bends backward, and joins the trunk of the pedicle about one-third or one-fourth of the length distant from the tip. The external cover of the pedicle, is formed by the soft skin, in the fold between the head and the mantle.

This organisation of the pedicles fully agrees with that of the *HELICIDÆ* in general, and makes it perfectly clear that the idea as to the non-retractibility of the pedicles in *Onchidium* cannot be retained. In all the species of *Onchidium*, of which I have observed live animals, I found the pedicles to be almost *entirely* retractile, but it is not usual that an animal, unless strongly irritated, does retract them fully, because the mantle which covers the head gives, as a rule, sufficient protection to them. Whenever specimens are, however, put in spirit, it is a common case that the strongly muscular mantle and the disc of the foot shrink more rapidly than the soft skin between them, and the head with its pedicles, and tentacles and buccal appendages is consequently easily pressed out. Thus the examination of specimens in spirit, evidently seems to have given ground to the idea, that the pedicles in *Onchidium* are not retractile. This observation appears to have been supported by the existence of two indentations, which are formed in the edge of the mantle above the pedicles, when the animal moves about. Occasionally these indentations, or grooves, are traceable for some time even after the death of the animal, but they are by no means permanent, and constantly change in live specimens. Whenever the animal retracts its head, and covers it from above with the mantle, and from below with the front edge of the foot, the indentations perfectly disappear in each such case.

The true tentacles are, as already noticed, in their entire length grown to the upper surface of the buccal appendages, and generally are with their external terminations connected with the extreme

outer edges of these. Both the tentacles and the front edges of the appendages are, as a rule, of a yellowish green colour and somewhat thickened; the former more so, being provided with numerous nerves, which issue directly from the anterior edge of the central ganglion, lying at the base of the head, and are a portion of those nerves which supply the lips. During the motion of the animal the tentacles are always moved in front of the edges of the buccal appendages, and when each of them are successively touched with a solid object, it will be observed, that the animal much easier responds to the former than to the latter; the first being the more sensitive organ.

#### *Habits.*

Dr. Buchannan says that he found *Onchidium typhæ* always on *Typha elephantina*. This plant is at present not nearly so common as the allied species, *Typha angustifolia*. However, that is no proof that both the species were formerly not more common than they are at present. No doubt, seventy years ago, swampy grounds, overgrown with vegetation, were more extensive about Calcutta, than they are now when our worthy municipality takes such good care to clear everything away! In places, however, (along the Eastern Bengal and the South Eastern and Calcutta railway lines, and in Alipore) where both species of *Typha* grow abundantly I have not been successful in procuring any *Onchidia* on the plants themselves. As a rule, these animals live, like *Limaces*, in damp places, generally close to tanks or ditches, especially those which are supplied during high tide with brackish water. They also seem to be common on the sea-shore, preferring the damp insular climate to that of large continents. Sometimes they are found in places which come under the influence of high tides. They either crawl about on the high ground between the vegetation, or on old wood and stones, etc. During the rainy season, they are naturally most numerous. When kept in a vessel with water, they often go voluntarily into it and remain for some time there, (as I have observed in *Onchidium tigrinum* and *pallidum*) until they are obliged to appear on the surface for the sake of breathing. In this point they fully agree with the species of *Scarabus*, and other estuary shells. *Onchidium tigrinum* sometimes voluntarily remained for 24 hours in brackish water, a small air-bubble being visible near its pulmonary orifice; *Onchidium typhæ*

does, however, not stand a long immersion in tank water, and in brackish water it dies much sooner. *Onchidium tenerum* burrows in soft mud, and appears on the surface only in warm weather after the rain. Lesson says of *Ochidium ferrugineum*, that it is a truly marine species, living as a rule, several feet below the surface of the water.

*Relations and probable identity of Onchidium with Onchidella and Peronia.*

I have given the anatomy of the type species, *Onchidium typhae*, in detail, because it must form the basis of further comparison with other species, which have been believed to belong to distinct generic types. Cuvier, in his admirable "Memoires, p. serv. l'histoire et l'anatomie des Mollusques," 1817, gave a very good account\* of the anatomy of *Onchidium Peronii* from Mauritius, and drew attention to the existence of a small British species, *Onch. cellicum*. Lesson, described several species in the "Voyage de la Coquille;" *O. granulatum*, *marmoratum*, *ater* et *ferrugineum*. A very good general figure and correct drawings of the different external organs are given by Savigny of the so-called *Peronia verruculata*, from the red sea, in the French Scientific Expedition to Egypt, (Moll. Pl. III). Quoy and Gaimard, in the "Voyage de l'Astrolabe" (Moll. Pl. XV) figure five species, but in none of them the position of the genital pores has been noticed. No details of the anatomy are given. Gray refers the largely tuberculated species, like *O. punctatum* and *Tongensis* to *Peronia*, the granular ones, like *O. patelloide* and *incisum* to *Onchidella*. Several other species of the same group of Molluscs were described by other authors from Mauritius, the Phillipines, etc. Keferstein lately (Zeitschrift für wiss. Zoologie, Bd. XV, 1864, p. 76-85) published some notes on *Janella*, *Aneitea*, and allied forms, but unfortunately I have not as yet been able to procure this paper. However, as far as the forms which interest us here specially are concerned there is sufficient for our purpose extracted in Bronn's "Klassen und Ordnungen des Thierreiches," Vol. III. On plate 105 a good side view is given of *Peronia verruculata*, shewing the correct position of the pulmonary,

\* The figures are reversely drawn, for instance in figures 2 and 5 the external *vas deferens* appears on the left side, and equally so the heart in figure 5, which represents an upper view.

anal and genital openings. Figure 2 on the same plate represents the genital organs, but does not seem to be very correct; in any case it is not sufficiently clear.

The reason,—that forms which appeared to such exact observers, as Cuvier, Lesson, Quoy and Gaimard, in all external characters to be generically identical with Buchanan's *Onchidium*, but which were by others separated as distinct genera,—evidently lies in the insufficient, and partially incorrect account which the last named author gave of his newly proposed genus, though very probably the desire of man, to discover *new* forms, had also something to do with it. The consequence, in short, was that the name *Onchidium* was reserved for the type species *Onchidium typhæ*, and other forms which were better known, than this, were separated into distinct genera. Now, when all the anatomical details of the type species are before us, we shall be able to draw a more accurate comparison between the same and other species.

Cuvier, as I have already stated, gave an excellent account of the anatomy of a Mauritian species which he called *O. Peronii*. Blainville in the 32nd vol. of the *Dict. de scienc. nat.* p. 280, proposed for this species the name *Peronia Mauritiana*,\* as the type of a new genus. When we compare externally the position of the anus, the hermaphrodite and male genital pores, and the pulmonary orifice, then the form of the head and the eye-pedicles &c., of Cuvier's original drawings, with those given of *Onchidium typhæ*, it will be readily seen that no essential distinction between them can be recorded. Even the granulation of the mantle is not much stronger, but it is said that the tubercles form (probably during life) short tufts. Referring to the other anatomical drawings, it must be admitted that they shew a perfect identity with those of *Onchidium typhæ*, if we set aside some minute details which are not perfectly clear in Cuvier's figure, and which are easily explained, when we consider that Cuvier had only specimens preserved in spirit for examination, and that many of those minute organs may consequently not have been preserved. Keferstein's and Savigny's figures of *O. Peronii* or *verruculatum* also fully agree with the typical *Onchidium*, as far as internal characters are concerned; the only difference being again the presence of tufts in place of simple

\* The rule, that specific names, unless pre-occupied, must not be changed, ought always to be observed.

granules. I had myself no opportunity of examining any of the forms called *Peronia*, but from the numerous variations in the external appearance of the tubercles, which I have observed in our species (as for instance in *O. tenerum*) I cannot perceive how this character could be considered as of any generic value. Besides that, the authors who acknowledge, upon this ground, the generic distinction of *Peronia*, are far from consistent in dealing with the question, for they refer to *Onchidella* species which are either smooth or granular, some of them being very coarsely granular, and even spinous above. Surely, the distinction between a smooth and granular or tubercular surface is greater than that between the latter and one in which the tubercles bear two or three points in place of only one. The presence of two or three black dots on some of the large tubercles of *Onchidium typhæ* appears to me to be fully equivalent to some of the tufts observed in *Onchidium Peronii*, and very likely in very old specimens these black dots may become pediculated, for I have myself observed them each raised independently from the other. I must here specially call attention to some of the variations in the mantle surface of *Onch. tenerum*, described towards the end of this paper.

Gray proposed for Lesson's species, *Onch. granulosum*, the name *Onchidella*, and referred to this presumed genus all the granular or smooth species, except *Onchidium typhæ*. In what the distinction of *Onchidium* and *Onchidella* ought to consist, I entirely fail to perceive. H. and A. Adams in their "Genera of Shells," II. p. 232, state that the latter differs from the former in having the buccal appendages *lobate*, but then they say exactly the same of *Onchidium*. I am not quite certain about the meaning of the word *lobate* with regard to the buccal appendages, but I think it can only refer to the thickened rims, which I explained as the tentacles and which, with reference to the front edges of the appendages, may be called *lobes*. Wherefrom H. and A. Adams derived the statement regarding the position of the pulmonary orifice "at the right side under the mantle," does not appear evident.

Lesson's figures of the ventral views of *Onch. granulosum* and *marmoratum* do not in the least support any generic distinction among the species described as *Onchidium*. In the former the anal and the respiratory orifices are marked in their proper

places, and the correct position of the sexual opening is indicated by the first portion of the external vas deferens. In the view of *O. marmoratum*, the vas deferens begins at the place where the pulmonary orifice is situated, which is no doubt a small error. None of the other figured species which have been referred to *Onchidella*, appear to me to add anything in support of a generic distinction, and thus I think that a very strong reason exists to withdraw both the generic names, *Peronia* and *Onchidella*, and refer the respective species to *Onchidium*.

The only other closely allied genus which belongs to the family ONCHIDIIDÆ is *Vaginulus* (*Veronicella* apud H. and A. Adams). Mr. W. Theobald, Junr., described one species from Burma, *V. Birmanicus*, and my friend, Mr. G. Nevill, lately obtained near Calcutta two specimens which appear to belong to the same species. I hope to return to this subject as soon as I am able to procure better live specimens of our own and the Burmese forms.

*Description of Bengal species.*

1. ***Onchidium typhæ***, Buch., 1800. Pl. xiv, Figs. 1—5.

Body during the motion of the animal much elongated and narrow, rather convex, anteriorly and posteriorly obtusely rounded; mantle above greenish, of various shades, covered with very numerous smaller and larger tubercles, which are nearly equally distributed over the whole upper surface. The smaller tubercles vary a little in their size, but the larger ones have pretty nearly the same dimensions, those about the centre of the back being slightly higher than others. These tubercles are at their bases and at the sides somewhat darker than the body, the top being, however, usually paler and provided with from 1—4 jet-black dots. None of the tubercles are permanent, they can be, in the live animal, always retracted in the skin which is rather tough.

The head is of considerable size, dark greyish, in front covered with numerous, rather large whitish warts; the buccal appendages are blackish, with their front edges and the tentacles yellowish green; the pedicles are thick, concentrically roughly wrinkled, slightly bluish, transparent at their base, greenish for the greater part of their length, pale near the tips, where the small black eyes are situated. The

mantle is below blackish, with a grey or brown tint, pale at the margins; the foot is greenish yellow, the dark colour of the digestive and the pale reddish colour of the generative organs shining through the skin. The width of the foot, which is little shorter than the mantle, amounts to about  $\frac{3}{8}$ ths of the width of the latter, but when the animal creeps about, it may be estimated at  $\frac{4}{5}$ th of that width; it is truncate in front and rounded posteriorly. The anus lies at the upper basal end of the foot, the opening being small and not distinct, covered by the terminal free edge of the foot. The pulmonary orifice is situated immediately beyond the anus, its internal margin is smooth. The hermaphrodite genital pore is a longitudinal slit, surrounded by swollen lips, situated about  $\frac{1}{10}$ th of an inch distant to the right of the anus. The external vas deferens, in the fold between the foot and the mantle, is marked as a white groove, and terminates in a minute pore below the right buccal appendage. The male genital pore lies in front, below the right pedicle. The dentition has been described previously (see p. 91, pl. xiv, fig. 6a).

The length of large specimens is about  $2\frac{1}{2}$  inches, and the width varies from one-third to one-fourth of it, when the animal moves about in its ordinary way. The usual length of pedicles is about half an inch. Old specimens, when fresh caught, very often secrete from the smooth lower portion of the mantle, a deep carmine red, gelatinous substance, of a distinct alkaline character. The substance coagulates in spirit, but is partially dissolved by, or is at least made thinner in, glycerine.

I have already mentioned, that this species is the commonest, and as yet the only one which was found near Calcutta. It is seen crawling about on old bricks, in ditches on the maidan, about the fort, along the Tollis-nullah (canal), and locally also on the banks of the Hooghly.

## 2.—*Onchidium pallidum*, *Stol.*, Pl. xv, Fig. 1.

Body elongated, moderately elevated, rounded anteriorly and posteriorly, generally covered with copious mucus. The mantle above is pale yellowish white, with a central, blackish, longitudinal stripe, commencing above the head, and extending posteriorly to about  $\frac{3}{4}$ th of the length of the body. It is accompanied on either side by a pale yellowish or greyish stripe, and the interspaces between these and the central stripe, are somewhat darker than the general colour of the

body. The entire surface is almost equally granular, with a small number of more or less regularly distributed larger tubercles, each provided with one, seldom two black dots. The larger tubercles were in one specimen arranged in two longitudinal rows on either side of the dorsal stripe, but in other specimens, they were irregularly placed. The black central stripe is widest in the middle, with a pale spot in the centre in which are situated three black dots; these being only observable in large specimens. The edges of the mantle are slightly thickened; its colour below being of the same, uniform, pale yellowish white hue, as above. The foot is obtusely pointed posteriorly and truncate in front; it is greyish yellow, varying in tints according to its expansion and consequent transparency; the colour of the internal organs is traceable through it.

The head and eye-pedicles are dark, with a distinct greenish tinge; the mantle and the buccal appendages paler; the front edges of the latter and the tentacles pale yellowish green. The length of the pedicles is generally less than half an inch, and they are somewhat thinner than in the previous species; the eyes are black.

The anus lies at the end of the foot; the pulmonary orifice just behind it, being rather small and surrounded by thickened margins. The hermaphrodite genital pore lies to the right, quite close to the anus; the external vas deferens enters the body on the side below the right buccal appendage, and the penis opening is situated in front, below the right pedicle. Young specimens are paler in colour than old ones, and the dorsal stripe becomes occasionally rather indistinct.

The disposition of the internal organs entirely agrees with the type species, *Onchidium typhæ*. The internal vas deferens is fully four inches long; the supplementary albuminous string, near the penis, is about 5 inches long, much shorter than in the previous species, but thicker in front; the liver at the end of the stomach is a large, dendritic gland; the receptaculum seminis is very large and folded; uterus thick and twisted, and like the small albuminous gland and the testis pure white; the large albuminous gland is purple or rose-coloured, the follicles being filled with a granular substance, which has the appearance of undeveloped eggs. The ovarium is deep yellow, containing large oval eggs. The cardiac cavity extends to nearly half the length of the body, but the heart itself

is only about  $\frac{3}{7}$ th of the length, distant from the posterior end. The penis is about  $\frac{8}{10}$ th of an inch long, thick and strongly constricted near the end, the flagellum being very short.

The dentition (fig. 1d) is similar to that of the last species, the lateral teeth are rounded at the base with one large and one small incurved denticle. I counted about 150 cross series and about 500 teeth in each the formula thus being 250-1-250.

The finely granular mantle with few scattered larger tubercles readily distinguish this species from the previous, and the large quantity of mucus which it secretes, has not been observed in any of the other forms. The narrower form and greater convexity of the body are equally characteristic distinctions between the present species and *O. tigrinum*, n. sp.

The species was found at Port Canning, and appears to be rare. I first obtained two large specimens through my friend G. Nevill. Both had in front on the right side a small portion of the edge of the foot detached (see fig. 1a), just on the place where the external vas deferens turns towards the buccal appendages. This detached portion had exactly the same structure as the rest of the foot disc, but whether it is an accidental formation, or a normal one, assisting during the act of copulation, I am not in a position to ascertain at the present. In several small specimens which I subsequently obtained myself on the banks of the Mutlah river, that particular detached piece was entirely wanting.

### 3.—*Onchidium tigrinum*, *Stol.*, Pl. xv, Fig. 2.

Body large, ovate, depressed; mantle strongly coriaceous, hardened, provided with sharp edges. The upper surface is entirely covered with small granules, between which more or less numerous large elongated tubercles are interspersed. Specimens of different sizes vary in this point a great deal; when young the tubercles are equally distributed between the granules, being three or four times as large, and each bearing a black dot at the tip, but being pale at the base. Old specimens have either two or three irregular rows of large elongated tubercles on each side of the back, or the larger tubercles are more numerous, more equally distributed and spinulose, so as to give the surface a very rough appearance. The latter stage is met with only in quite

fresh and very large specimens; when they are kept for only a short time, all the fine spines are retracted in the mantle.

The colour is above pale green with numerous blackish, irregular spots, which are generally more numerous about the centre of the back and at the edges of the mantle, than between both. Young specimens are more uniformly coloured. In the old ones, the green colour is sometimes rather dark, so as to make the spots less conspicuous; in others there is a distinct blackish green irregular stripe along the centre of the back, of about the same length as the foot; two similar blackish stripes originate one behind each of the pedicles, running a short distance from it more or less parallel to the dorsal stripe, till all three join near the posterior end. Both the central and the lateral stripes are not continuous, they are moreover formed by the spots becoming more or less confluent. Young specimens have the mantle below uniform, light bluish with very numerous and minute white dots; large ones have occasionally a number of dark green or rusty, more or less confluent spots along the lateral margins, and the general colour is paler. The foot is comparatively narrow, about one-third of the width of the body and when contracted about one-fourth only; it is of a uniform dark bluish grey colour, sub-truncate anteriorly and rounded or obtusely pointed posteriorly, with the edges free and sharpened all round.

The head and the pedicles are dark green, the latter far apart, thick at the base, very thin in the middle, with slightly thickened tips which bear the black eyes at their upper surface. The buccal appendages are of moderate size, blackish, with greenish grey front edges, and the tentacular rims yellowish green. The male genital pore is very distinct, situated in front at the base of the right pedicle; the anus and the pulmonary orifice are normal, the hermaphrodite opening about  $\frac{1}{8}$ th of an inch distant to the right of the anus, elongated, and surrounded with swollen lips; the external vas deferens enters the body below the right buccal appendage, but very close to the lips of the mouth, passing obliquely through the tissue towards the male genital pore.

All the internal organs agree with the type species. The ovarium is small, orange yellow; the testis, and its supplementary gland, white, the albuminous gland and the uterus pale

yellowish white. The receptaculum seminis is a comparatively very small globular capsule, the oviduct being, however, very strong, almost horny; the portion of the liver covering the end of the stomach is cup-shaped and small; the intestines and the rest of the liver normal; the penis above an inch long, with a setous flagellum; the internal vas deferens is about 5 inches, and its supplementary albuminous string about 8 inches long, almost equally thin throughout. The pulmonary cavity is large with numerous cross-folds, the lungs yellowish. The heart is small, white, the aorta at the beginning not much narrower, the thicker branch going to the digestive organs.

The radula is particularly narrow in this species, but the teeth are very similar to those of *Onch. typhæ*, the laterals being only a little larger.

This species is rather common along the banks of the Mutlah at Port Canning, it is generally seen creeping about on old wood. It survives a long immersion in brackish water, but shrinks and soon dies in sweet water. I often found it in holes or at the roots of bushes on the bank of the river during low water; when the water rose the specimens must have been fully for 8 hours submerged. The largest specimen, measured, was two inches long, and about the middle  $1\frac{2}{10}$  of an inch broad.

The broad, depressed form of the body, the narrow foot, thin eye-pedicles and the solid coriaceous structure of the mantle, readily distinguish this species from others.

#### 4.—*Onchidium tenerum*, *Stol.*, Pl. xv, Fig. 3.

The general form of the body is oval, more or less elongated, but very high, it is remarkably soft, almost pulpy in fresh caught specimens, always enveloped in a thin layer of secreted mucus. The ground colour of the upper surface of the mantle is greenish grey, irregularly mottled and spotted with dark. Two obtusely elevated, somewhat undulating and pale coloured, ridges run from the edges of the mantle above the eye-pedicles posteriorly near to the end, enclosing a central area of the back, in which a number of very large oval tubercles are situated. These are of a greenish colour, covered with smaller warts, their tips being yellowish, and each of them provided with from 1—3 black dots. Full grown specimens have besides a row of similar large tubercles running externally and parallel to the ridges

which enclose the central dorsal area. The entire mantle is more or less finely granular. All the tubercles are much less developed in young specimens, and even in old ones their form constantly changes, on account of the softness of the body, in which they can be entirely retracted, making the mantle to appear uniformly convex. Young and half grown specimens generally have on the external side of the dorsal ridges, two or three of the blackish spots larger, separated by oval pale orange spots which sometimes are partially confluent, forming longitudinal stripes, the orange colour also partially extending on the ridges themselves.

The mantle below is uniform pale greenish grey, with very minute and numerous white dots, the same being also traceable on the sides of the foot. The latter is blackish green, little shorter than the mantle, obtuse or slightly rounded in front, pointed at the posterior termination when free, but when the animal moves about on a flat surface, it appears rounded. The width of the foot is on an average  $\frac{3}{4}$ th of that of the body, occasionally somewhat less. The head is very large, greenish, covered in front with numerous ashy warts: the buccal appendages laterally widely expanded, with the front edges slightly swollen, the tentacular rims above them being very thin, and of an ashy grey colour. The eye-pedicles are stout at the base, when extended about half an inch long, slightly warty, concentrically wrinkled, with the tips distinctly swollen, globular, pale yellowish or reddish, bearing the black eyes almost centrally situated in a lighter transverse fold. The lips of the mouth are whitish, strongly thickened and folded. The anus is as usually placed at the upper terminal base of the foot; the pulmonary orifice is removed from it and close to the posterior end of the mantle; it is large, surrounded by a strong swollen margin, internally white, with 8—10 small tubercles, which continue interiorly as short ridges. The hermaphrodite pore is also somewhat removed from the anus, about half an inch distant from it to the right, but situated as in all other *Onchidia* in the fold between the mantle and the foot. The external vas deferens is a distinct narrow groove, entering the body at the outer base of the right oral appendage, although it seems to continue below the mouth, issuing internally quite close to the penis opening. The penis pore itself is large, placed laterally below the right eye-pedicle.

The internal organisation does not essentially differ from the type. The oesophagus is comparatively small, the alimentary canal rather long and thick; the liver extensive and deep greenish; stomach very muscular and large. The internal vas deferens is very thin, yellow, about three inches long, and twisted round the penis which is about  $\frac{8}{10}$ th of an inch long, very thick, but otherwise not offering any distinctions. Its supplementary albuminous string is thick, white, and at least 12 inches long, it almost occupies one-third of the body cavity just behind the head. The hermaphrodite organ is not very extensive, the large albuminous gland of a purplish colour; ovarium deep, yellow; testis white, small albuminous gland yellowish white; the vas deferens, issuing from the testis, is very thin, accompanying the strong and thick oviduct; the receptaculum seminis is represented by a small, oval, dark coloured gland, closely attached to the oviduct.

The nervous ganglion behind the oesophagus is particularly large, sending numerous branches in all directions. The dentition is also similar to the other species, the centrals have a very small point, and the laterals form distinct hooks with an upright point at the end.

The softness of the body, its great height, the peculiarly formed tubercles of the mantle, and the situation of the pulmonary, hermaphrodite and male genital openings, are the characteristic distinctions of this species.

It has been found, at the end of the rainy season,—in September and October,—on the banks of the Mutlah river at Port Canning, but appears to be rare. Its habits are peculiar; it burrows in mud, sometimes several inches deep, and appears on the surface merely after, or during, the rain of a warm day. This evidently accounts for the softness of the body. A few specimens which I kept in a glass instantly burrowed in the soft earth, lying in holes in an oblique or perpendicular position with the posterior tip of the mantle, where the pulmonary orifice is situated, exposed so as to permit free access of air. They sometimes did not appear on the surface for many days, except when covered up and then placed in the sun.

*Explanation of letters in Plates XIV and XV.*

- æ*.—œsophagus.
- ac*.—alimentary canal.
- ps*.—supplementary albuminous gland of the penis.
- l*.—liver.
- r*.—rectum.
- t*. (or *ts*) testis.
- o*. (or *as* in fig. 5) ovarium.
- p*.—penis.
- pp*.—penis opening.
- sg*.—salivary glands.
- pe*.—eye-pedicle.
- tt*.—tentacle, except in fig. 1a, of Pl. XIV, being = buccal appendage.
- i*.—intestine.
- pst*.—first portion of the stomach.
- st*.—middle portion of the stomach.
- mst*.—muscular, middle part of the same.
- m*.—terminal part of the same.
- ag*.—albuminous gland of the generative organs.
- as*.—in fig. 2, albuminous gland of the testis.
- ht*.—heart.
- rs*.—receptaculum seminis.
- gp*. and *pa*.—supplementary glands (kidneys, &c.?) of the rectum.
- g o*. or *g v*.—hermaphrodite genital opening.
- a*.—(in figs. 2 and 5) anus.
- ol*.—pulmonary orifice.
- l*.—lungs.
- rm*.—retractile muscle.
- n*.—nerves.
- ng*.—chief ganglion.
- dn*.—nerve of the digestive organs.
- bs*.—base.
- cp*.—cartilaginous plates supporting the radula.
- to*.—tongue.
- ra*.—radula.

go. (in fig. 1. c) middle genital pore.

f.—foot.

d.—dorsal part of the mantle.

vd.—vas deferens.

vdo.—opening by which the external vas deferens enters the body.

ba, in fig. 5.—buccal appendage.

tp.—external covering of the eye-pedicle.

ov.—oviduct.

#### Pl. XIV.

Fig. 1, 1 a, 1 b, 1 c, dorsal, ventral, side and front views of *Onch. typhæ*; the figure between 1 and 1 a, represents the eye-pedicle, isolated and enlarged.

Fig. 2. A large specimen of *Onch. typhæ*, cut open along the centre of the back, the internal organs being exposed.

Fig. 3. A small portion of the edge of the mantle showing the internal cavities.

Fig. 4. Œsophagus, cut open, with the radula, salivary glands, &c.

Fig. 5. Internal organisation of *Onch. typhæ*.

Fig. 6, radula, 6 a, central and a few lateral teeth, 6 b, side view of the central, and 6 c side view of the lateral tooth; all greatly enlarged.

#### Pl. XV.

Fig. 1, and 1 a, dorsal, and ventral, views of *O. pallidum*; 1 b, radula, 1 d, central and lateral teeth, 1 e, side view of a lateral tooth;.

Fig. 2, 2 a, 2 b, dorsal, side, and ventral, views of *O. tigrinum*; 2 c, radula; 2 d, central and lateral teeth; 2 e, side view of a central, 2 f, side view of a lateral tooth.

Fig. 3, 3 a, 3 b, 3 g, dorsal, ventral, side, and front, views of *O. tenerum*; 3 c, radula, 3 d, central and lateral teeth, 3 e, side view of a central, 3 f, side and front views of a lateral tooth.

N. B.—The figures of the teeth are in all cases enlarged.



*Notes on the Flora of Manbhúm ; by V. BALL, ESQ., B. A., Geological Survey of India.*

[Read 4th Nov., 1868 ; received 5th Nov., 1868.]

The district of Manbhúm which, until comparatively recent times, formed a portion of those *terræ incognitæ*, the *jungle mehals*, has not been altogether neglected by naturalists. The fauna, first examined by Col. (then Lieut.) Tickell, and more recently by Captain Beavan, is now pretty well known.

The flora of the northern portion of the district in the vicinity of the grand trunk road, received the attention of several distinguished botanists, but in the southern portion plants never have before been collected.

Dr. Hooker, in his introductory essay to the *Flora Indica*, after noting the character of the flora of the humid Eastern ghats of Orissa, which, owing to circumstances which he describes, are during both monsoons, daily affected by moist sea breezes, states that the vegetation of the interior of the province (which includes the greater portion of Manbhúm) is quite unknown, except from a few notices in Major Kittoe's journey to the Sumbulpúr valley.

Dr. T. Anderson's paper in the journal\* is devoted to an account of the flora of northern Manbhúm, (in the vicinity of the trunk road), Behár and Parisnáth hill, upon which latter, temperate forms, all of Himalayan species, are found. His list contains most of the species which I have met with in the lower portions of Manbhúm ; there are, however, some important additions.

As it is often equally important in botanical examinations to trace a resemblance as well as a difference between the floras of adjoining areas, I have ventured to give the following account of the portions of the district which have been visited by me during my geological Survey.

As on a previous occasion, I must again acknowledge the assistance which I have ever readily received from Mr. Kurz, who has examined all my collections, and who also paid me a short visit when I was encamped near Beharináth hill. Such assistance is invaluable in Calcutta where, in order to consult the Herbarium and the Botanical

\* J. A. S. B.

library, it is necessary to undergo so much trouble and expenditure of time, as is involved in a trip to Seebpúr.

The district of Manbhúm forms portions of three of Dr. Hooker's provinces, Behár, Bengal and Orissa, the larger portion being included in Orissa. As I expect to have further opportunity of examining that province throughout, I shall for the present confine myself to a description of the more salient features of the flora; reserving the detailed list of plants to some future time. The physical characters of the district of Manbhúm may be most clearly comprehended by dividing it up into a series of six zones as follows:

*1st.* A zone in which metamorphic rocks alone prevail, and of which the general altitude is probably about 4 to 500 feet, and which is studded with small hills rising 3 to 400 feet higher.

*2nd.* The Damuda valley in which the two coal fields of Ranigunj and Jherria are situated. This zone includes the hills of Pachete and Beharináth, formed of the youngest sedimentary rocks and rising to the heights, respectively, of 1,600 and 1,480 feet.

*3rd.* A zone similar to the first, in which metamorphic rocks only occur, and which is studded with many hills of which Susinia (1400'), Rugonathpúr and Sindurpúr are the principal. It includes the valleys of the Selye, Dulkissur and Cossye rivers.

*4th.* A zone upwards of two-thirds of which are in no respect different from the preceding one, but of which the remaining portion, the western, is occupied by the Bhaghmuri plateau, one of the most important spurs running from the highlands of Chota-Nagpúr. It is formed of granitic gneiss which weathers into huge and magnificent monoliths. The general level of the plateau is probably about 1,500 feet above the sea, that of the plain at the base being 720 feet.

*5th.* A zone similar to No. 3, in which a few unimportant hills occur. The rocks belong to two formations the metamorphic, or gneiss series, and the sub-metamorphic, or slate and quartzite series.

*6th.* Finally Manbhúm is separated from Dhalbhúm and Singhbhúm on the south by a series of ranges of hills formed of the harder rocks belonging to the sub-metamorphic series: quartzites, tough schists, slates, and trap. Between these ranges which rise to various heights from 1,000 to 3,000 feet, are deep valleys in which the vegetation,

owing to the greater amount of moisture, is different from that of the open plains.

At first sight, there is much in the general aspect presented by the flora of Manbhúm and the adjoining districts, which is most disappointing; instead of meeting with a realization of one's ideal of a tropical jungle, the effect produced by the vegetation is, in many places, not strikingly different to what we have been accustomed to in the British Isles.

Dr. Hooker first drew attention to the park-like aspect which prevails in the drier and clearer portions of these districts.

*Bassia*, the *tamarind*, the several species of *Ficus*, *Butea* and the *Sal*, representing, without any great stretch of the imagination being necessary, the *Oaks*, *Pines*, *Sycamores*, *Maples* and *Poplars* of temperate climes.

It is only on the hills, and in the valleys of the sixth zone, that one meets with anything like typical tropical jungle; even in these comparatively favourable localities there are no tree-ferns, nor palms, and but few mosses, orchids or herbaceous ferns.

Contrasting the flora in detail with that of the British Isles, one is struck by the absence of plants belonging to such common orders as *Rosaceæ*, *Cruciferae*, *Geraniaceæ*, *Violaceæ* and the rareness of species belonging to *Ranunculaceæ*, *Umbelliferæ* and *Scrophularinææ*.

On the other hand, many of the pond-weeds, *Chara*, *Nymphæa*, *Potamogeton*, *Alisma*, &c., as well as grasses, *Cyperus*, ferns, *Drosera*, *Arums*, *Oxalis*, *Mistletoe*, some of the smaller *Labiatae*, and both herbaceous and arboreal forms of *Leguminosæ*, together with a *Salix*, vividly recall their European congeners. Lichens might be added to this list. It is interesting to observe that these are seldom to be found, except on the northern or sheltered faces of the trees, and rocks upon which they grow.

Throughout the jungles both of the plains and hills, the deep glossy green of the *Sal*, *Shorea robusta*, Roxb., gives a marked character to the foliage. In the early part of the year, the white floral leaves of *Combretum Roxburghii*, and other species, produce a pleasing contrast in the sea of green which meets the eye in every direction. At the commencement of the hot weather, the greater number of the trees lose their leaves which, in some species, are immediately re-

placed, when lovely contrasts are produced by such varied hues as the deep purple of the young leaves of *Schleichera trijuga*, Willd., with an infinitude of shades of red, white and green on the surrounding trees.

While the trees remain leafless, the aspect of the jungle is bleak and wintry, this is intensified by the action of the jungle fires, which scorch up all the herbage, so that there is often little shade to be found, when most wanted from the hot sun of April.

The inflorescence, as a general rule, is of a dull and subdued character. That of the *Sal* produces a peculiar hazy appearance over the green foliage. The most brilliant flowers are those of *Bombax Malabaricum*, *Butea frondosa* and *B. superba*; perhaps the most beautiful are the white and delicately-violet tinted blossoms of a species of *Bauhinia*. In the flat portions of the district which constitute the 1st, 2nd, 3rd, part of 4th and 5th zones, a four-fold division according to the character of the vegetation may be made.

FIRST. Original jungle land in which trees are of large size.

SECOND. Stunted jungle land from which timber is regularly cut, and where the trees are never allowed to attain respectable dimensions.

THIRD. Dry, gravelly and raviny or rocky ground incapable of supporting a tree jungle.

FOURTH. Land under cultivation, or which has at some former time been under cultivation.

In the *first* division the characteristic trees are the following :

*Shorea robusta*, Roxb.

*Terminalia glabra*, Roxb.

*Buchanania latifolia*, Roxb.

*Semecarpus anacardium*, L.

*Grislea tomentosa*, Roxb.

*Croton oblongifolium*, Roxb.

*Phyllanthus emblica*, L.

*Lagerstroemia parviflora*, Roxb.

*Symplocos racemosa*?

*Conocarpus latifolia*, Roxb.

*Holarrhæna antidysenterica*, Wall.

*Randia dumetorum*, Lam.

*R— longispina*, DC.

*Eugenia jambolana*, Lam.

*Gardenia latifolia* Ait.  
 G— sp. (*lucida* ?)  
*Pavetta Indica*, Linn.  
 P— *parviflora*, Roxb.  
*Wendlandia tinctoria*, DC.  
*Cassia fistula*, Linn.  
*Calosanthes Indica*, Blume.  
*Stereospermum suaveolens*, DC.  
*Ægle Marmelos*, Corr.  
*Carissa Carandas*, L.  
*Zizyphus ænopia*, Mill.  
*Combretum Roxburghii*, DC.  
*Casearia tomentosa*, Roxb.  
*Glochidron* Sp.  
*Nauclea parvifolia*, Roxb.  
 N— *cordifolia*, Roxb.

Herbaceous plants are scarce in jungle of the above character, doubtless they are more abundant during the rains.

The large scandent creepers are more commonly met with on the hills, but they also occur in the older jungles, the principal species are *Bauhinia Vahlia* and *Butea superba*.

Parasites and epiphytes are represented by two species of *Loranthus*, two of *Viscum* and a few orchids.

It is often to be observed that some one of the trees, mentioned in the preceding list, occurs in such abundance throughout a limited area, as almost to exclude all other species; some circumstances, which it is impossible to detect, giving it pre-eminence in the struggle for life. The species so occurring are :

*Shorea robusta*, Roxb.  
*Terminalia glabra*, W. and A.  
*Holarrhæna antidysenterica*, Wall.  
*Conocarpus latifolia*, Roxb.  
*Eugenia Jambolana*, Lam.  
*Casearia tomentosa*, Roxb.

Modification of the character in the vegetation can, however, in two instances at least be traced to its prime causes, viz. the vicinity

either of hills or of rivers. The species which are most frequently found at the foot of the hills are :

*Combretum Roxburghii*, D'C.

*Lebidieropsis orbiculata*, Müll.

*Nyctanthes arbor tristis*, L.

*Schleichera trijuga*, Willd.

*Flacourtia sapida*, Roxb.

*Terminalia chebula*, Retz.

*Antidesma bunias*, Spreng.

A— *diandrum*, Tul.

*Feronia elephantum*, Corr.

*Ichnocarpus frutescens*, R. Br.

*Bauhinia variegata*, Lin.

B— *purpurea*, Lin.

*Ventilago calyculata*, Tul.

*Rivea ornata*, Choisy.

*Hoya viridiflora*, R. Br.

The species occurring on river banks are :

*Terminalia arjuna*, W. and A.

*Eugenia* sp.

*Melanthesa rhamnoides*, Bl.

*Salix tetrasperma*, Roxb.

*Hyptianthera stricta*, W. and A.

*Erycibe paniculata*, Roxb.

*Briedelia tomentosa*.

*Barringtonia acutangula*, Gaertn.

*Butea parviflora*, Roxb.

*Olax scandens*, Roxb.

*Cæsalpinia digyna*, Rottl.

*Millettia fruticosa* ?

*Zizyphus cænopia*, Mill.

*Vitis* sp.

The *second* division, the stunted jungle, can hardly be said to possess any characteristic vegetation of its own, rather, it may be said that in it the types of the three others meet. The vegetation of the

original jungle is encroached upon by that which accompanies cultivation, and the absence of large trees and shelter tends to produce the dry raviny, ground, of the *third* division which can only support its own spare vegetation, consisting chiefly of—

*Phoenix acaulis*, Buch.

*Calotropis gigantea*, R. Br.

*Vitex trifolia*, L.

*Barleria cristata*, L.

*Lepidagathis cristata*, Willd.,

with grasses and dwarfed bushes of *Zizyphus*, *Sal* and *Diospyros*.

In the *fourth* division the influence which clearing and cultivation exercise upon the flora, is marked and irradicable, and though deserted village lands often relapse into jungle, such jungle always contains trees which, never occurring in the primitive forests, proclaim, by their presence, the antecedents of that particular spot.

The trees most commonly occurring in cleared or cultivated areas are :

*Bassia latifolia*, Roxb.

*Butea frondosa*, Roxb.

*Diospyros exsculpta*, Ham. ?

*Zizyphus jujuba*, Lam.

*Ficus Indica*, L.

*F— religiosa*, L.

*Alangium deca-petalum*, Lam.

*Trophis aspera*, Retz.

*Mimusops elengi*, L.

*Alstonia scholaris*, R. Br.

*Terminalia bellerica*, Roxb.

*Bombax Malabaricum*, DC.

*Spondias mangifera*, Pers.

*Odina wodier*, Roxb.

Other trees occur, but more sparingly, and they may possibly have been introduced.

Of herbaceous plants, a long list might be quoted, the rice-fields alone furnishing a large number. The most common forms met with in the hedge rows and groves are :

*Clerodendron infortunatum*, L.  
*Argemone Mexicana*, L.  
*Hygrophila spinosa*, T. Anders.  
*Aerva lanata*, Juss.  
*Solanum xanthocarpum*, Schrad.  
*Cordia Myxa*, L.  
*Trichodesma Indica*, R. Br.  
*Sida Asiatica*, L.  
 S— *cordifolia*, L.  
 S— *humilis*, Willd.  
*Jatropha gossypifolia*,  
 J— *Curcas*, L.  
*Abrus precatorius*, L.  
*Cardiospermum Halicacabum*, L.  
*Bryophyllum calycinum*.

The bushes of *Zizyphus jujuba* are generally covered with a beautiful net-work of dodders, both species *Cassytha filiformis* and *Cuscuta reflexa* (?) occurring abundantly.

Besides the above, some of which though not indigenous are perfectly naturalised, there are a number of trees which are regularly cultivated; they are—

*Mangifera Indica*, L.  
*Moringa pterygospermum*, Gaertn  
*Punica granatum*, L.  
*Psidium Guava*, L.  
*Anona squamosa*, L.  
*Tamarindus Indica*, L.  
*Ricinus communis*, L.  
*Azadirachta Indica*, Ad. Juss.  
*Zizyphus jujuba*, Lam (var.)

On the bunds of tanks, the following trees are generally planted.

*Acacia Arabica*, Willd.  
 — *farnesiana*, Willd.  
*Borassus flabelliformis*, L.  
*Terminalia Arjuna*, W. and A.

*Plumieria alba*, Jacq.

*Nerium odorum*, Ait.

A very beautiful effect is often produced by the so-called matrimony of the species of *Ficus* with other trees, more especially with the *Tal*, *Borassus flabelliformis* : the seeds of *Peepul*, dropped by birds into the angle formed by the leaf stalk of the *Tal*, produce trees which ultimately envelope with their roots and stem the whole of their foster parent.

The flora of the tanks and jheels is interesting, as it approaches in character that of the ponds and lakes of Europe. The principal species are :

*Nymphæa lotus*, L.

N— *stellata*, Willd.

*Hydrilla verticillata*?

*Ottelia alismoides*, DC.

*Nelumbium speciosum*, Willd.

*Limnanthemum cristatum*, Griseb.

*Potamogeton natans*, Linn.

*Azolla pinnata*, R. Br.

*Marsilea quadrifoliata*, L.

At the edges :

*Exacum sulcatum*.

*Drosera Burmanni*, Vahl.

*Scirpus mucronatus*.

*Fuirena ciliaris*.

A number of species of *Cyperus* and grasses.

On all the smaller hills up to 1,000 feet, the greater number of species occurring on the plains are to be met with, and in addition to them many species of both trees and herbaceous plants, which are never found below ; on the highest hills the jungle consists almost exclusively of *Bambusa stricta*, with an undergrowth in which the blue flowers of *Strobilanthes auriculatus* and *Dædalacanthus purpurascens* are the most prominent forms.

The following is a list of the most characteristic trees occurring on the hills :

*Kydia calycina*, Roxb.

*Cochlospermum gossypium*, D'C.  
*Dillenia pentagyna*, Roxb.  
*Sterculia urens*, Roxb.  
*Chickrassia tabularis*, A. Juss.  
*Zizyphus rugosa*, Lam ?  
*Nauclea parvifolia*, Roxb.  
*Hymenodictyon thyrsiflorum*, Wall.  
*Flacourtia cataphracta*, Roxb.  
*Spermodictyon azurea*.  
*Nyctanthes arbor tristis* L.  
*Celastrus paniculatus*, Willd.  
*Dalbergia latifolia*, Roxb.  
*Albizzia procera*, Bth.  
*Acacia tomentosa*, Willd.  
*Ficus parasitica*, Koen.  
*Hibiscus vitrifolius*, L.  
*Helicteres Isora*, L.  
*Butea superba*, Roxb.  
*Grewia hirsuta*, Vhl.  
*G— elastica*, Royle.  
*Flemingia strobilifera*, R. Br.  
 — *nana*, Roxb.  
*Desmodium latifolium*, D'C.

The useful plants of Manbhúm may be classified into those yielding :  
 Food, Drugs, Fibres, Dyes, Lac, Oil, and Timber.

**Food.** I have in a previous communication to the Society\* shewn what a large number of jungle products are used as articles of food ; and that a considerable portion of the poorer natives derive from them their principal subsistence during several months of the year.

**Drugs.** A large number of the well-known drugs of India occur in Manbhúm ; of others, some of which are possibly peculiar to that part of the country, I have made a small collection, but am unable to say whether they really are equal to their reputed virtues.

In making enquiries on these subjects, I have often been struck with the curious contrasts of the deep knowledge possessed of the specific virtues of certain plants, and the dense ignorance and supersti-

\* J. A. S. B. 1867, Vol. XXXVI. Pt. II. No. II. p. 73.

tion which attributes fantastical virtues to others. The same man who may bring you the roots of one plant, which are of known medicinal value, will shew you the seeds of another which he asserts are of infallible efficacy in certain diseases, when tied round the neck on a string. I have seen a man going about, with a small parcel of medicine suspended from one of his ears, which he complacently told me, was for the purpose of killing, what he fancied was a worm in his tooth.

**FIBRES.** The fibres of many of the large scandent creepers are used in the manufacture of coarse ropes. I have never been able to ascertain that the fibre of the Mudar, *Calotropis gigantea*, is collected, though it is one of the most valuable in India.

**DYES.** Coloured clothing is scarcely ever worn by the natives of Manbhúm, so that there are very few dyes in use. On special occasions when gaudy clothing is required, yellow, which is produced by turmeric, seems to be the favourite colour. Non-permanent dyes are sometimes made out of some of the brilliant coloured blossoms of *Butea superba*, *Grislea tomentosa*, &c.

**LAC.** The principal lac yielding trees are *Plas*, *Butea frondosa* and *Khúsúm*, *Schleichera trijuga*: the lac is purchased at a very low rate by the Mahajúns, and yields them a considerable profit when they bring it to markets attended by the regular dealers.

**OIL.** There are a number of trees yielding a variety of oils, for some of which medicinal virtues are claimed, others produce inferior oils, which are used either in their food, by the very poorest classes, or for burning. It is unnecessary to detail the plants here, as they are all well-known to yield oil. Were it not that crops of oil-yielding plants such as *Mustard*, *Guizotia*, *Sesamum*, *Castor Oil*, &c., are extensively grown throughout the district, more importance would attach to the jungle oils than does at present.

**TIMBER.** The useful timber to be found in Manbhúm, is very limited in quantity, the forests covering but a small portion of the area. Already contractors, and their agents, have reached the hills on the Dhalbhúm frontier, and at the rate at which *Sal* is now being cut for Railway sleepers the supply cannot last for many years.

Although *Sal* is the only timber cut for exportation, about 30

species of trees, yielding either ornamental, or strong and durable woods, occur in tolerable abundance.

In the report of the Jury in Section IV, Class IV, of the Madras Exhibition, 1855, there is a list given of woods with their respective properties. Many of the species mentioned, are to be found in Manbhúm. From the information contained in this list, from personal observation, and other sources, I have drawn up the following enumeration of timber trees with their local names and special properties :

| Names.                   | Local names<br>Bengali. | Character of timber.                                |
|--------------------------|-------------------------|-----------------------------------------------------|
| Acacia Arabica,          | ... Babúl.              | Hard and tough, but small sized, used for wheels.   |
| A— catechu,              | ... Koir.               | Small, produces <i>kut</i> .                        |
| Ægle marmelos,           | ... Bael.               | Wood, strong.                                       |
| Alangium decapetalum,    | ... Ankúra.             | Wood, beautiful.                                    |
| Artocarpus integrifolia, | ... Kantal.             | Excellent, used for furniture.                      |
| Azadirachta Indica,      | ... Neem.               | Beautiful, suitable for ornamental work.            |
| Bassia latifolia,        | ... Mhowa.              | Strong, but tree is too valuable to be cut down.    |
| Barringtonia acutangula, | ... ..                  | Useless.                                            |
| Bauhinia variegata,      | ... Katchna.            | Little use.                                         |
| B— malabarica,           | ... ..                  | Said to be hard.                                    |
| Borassus flabelliformis, | ... Tál.                | Used for rafters, &c.                               |
| Buchanania latifolia,    | ... Píál.               | Useless.                                            |
| Butea frondosa,          | ... Plás.               | "                                                   |
| Casearia tomentosa,      | ... Moun.               | "                                                   |
| Calosanthus Indica,      | ... Sona.               | Soft, useless.                                      |
| Cochlospermum gossypium, | ... Gol-gol.            | Useless.                                            |
| Conocarpus latifolius,   | ... Dow.                | Very strong and useful, light-coloured.             |
| Croton oblongifolius,    | ... Pútha.              | Reddish, cracks.                                    |
| Dillenia pentagyna,      | ... Kurkotta.           | Strong and durable wood, splits easily.             |
| Feronia elephantum,      | ... Kuth-Bael.          | Hard, strong, heavy wood.                           |
| Ficus Indica,            | ... Bur.                | Branch stems, heavy, hard, suitable for tent poles. |
| ,, religiosa,            | ... Pipul.              | Useless.                                            |
| Flacourtia sapida,       | ... Benchi Kátái.       | Hard, does not warp.                                |

| Names,                                | Local names<br>Bengali. | Character of timber.                                    |
|---------------------------------------|-------------------------|---------------------------------------------------------|
| <i>Gardenia latifolia</i> , ...       | Pepero.                 | Close-grained.                                          |
| <i>Holarrhæna antidysenterica</i>     | Kúrchí.                 | Useless.                                                |
| <i>Lagerstroemia parviflora</i> ,...  | Seed or See-<br>dhar.   | Wood said to be good.                                   |
| <i>Mangifera Indica</i> , ...         | Am.                     | Durable, used for making<br>packing-cases.              |
| <i>Melia azadirach</i> , ...          | Bukum ?                 | Durable and handsome.                                   |
| <i>Nauclea cadamba</i> , ...          | Kadam.                  | Used for furniture.                                     |
| N— <i>cordifolia</i> , ...            | Petpuria.               | Yellow, used for common<br>purposes, easily worked.     |
| <i>Nyctanthes arbor tristis</i> , ... | Seolee.                 | Hard, but small.                                        |
| <i>Odina Wodier</i> , ...             | Amará.                  | Central wood useful.                                    |
| <i>Pavetta Indica</i> , ...           | .....                   | Timber small.                                           |
| „ <i>tomentosa</i> , ...              | .....                   | Hard, but small.                                        |
| <i>Phyllanthus emblica</i> , ...      | Aura.                   | Hard, valuable.                                         |
| <i>Rottlera tinctoria</i> , ...       | .....                   | Wood soft and inferior.                                 |
| <i>Schleichera trijuga</i> , ...      | Khúsúm.                 | Strong, suitable for spokes,<br>&c.                     |
| <i>Semecarpus Anacardium</i> , .      | Belá.                   | Useless.                                                |
| <i>Shorea robusta</i> , ...           | Sál.                    | Extensively used in India<br>for rafters, sleepers, &c. |
| <i>Sterculia urens</i> , ...          | Keonge.                 | Soft and useless.                                       |
| <i>Stereospermum suaveolens</i> ,     | Páruł.                  | Strong and elastic.                                     |
| <i>Strychnos nux vomica</i> , ...     | Kúchilá.                | Hard, used for plough-<br>shares.                       |
| <i>Eugenia Jambolana</i> , ...        | Jám.                    | Not attacked by white<br>ants.                          |
| <i>Tamarindus Indica</i> , ...        | Emle.                   | Hard, durable.                                          |
| <i>Trophis aspera</i> , ...           | Soura.                  | Only used for fuel.                                     |
| <i>Terminalia glabra</i> , ...        | Asun.                   | General work, durable under<br>water.                   |
| T— <i>chebula</i> , ...               | Hurtoki.                | Coarse, but sound and dur-<br>able.                     |
| T— <i>bellerica</i> , ...             | Bhora.                  | White and soft.                                         |
| <i>Zizyphus jujuba</i> , ...          | Bier.                   | Hard and useful, but of<br>small size.                  |

*Contributions to Indian Malacology, No. X. Descriptions of new species of Cyclophoridae, of Ennea and Streptaxis from the hills of Southern and South-western India; by WILLIAM T. BLANFORD, A. R. S. M., F. G. S., &c.*

[Read 3rd February,—received 18th February, 1869.\*]

The shells described in the following pages are some very interesting forms discovered by Major Beddome and Mr. Fairbank in South Canara, the Pulney hills, and the ranges on the frontier of Travancore. All belong to the Malabar province, a remarkable zoological "outlier" of the Malay fauna.

The first three species, all of which have been discovered by Major Beddome in the hills of Travancore and the neighbourhood, differ from any previously described, so much, as to constitute a section or sub-genus by themselves. Instead of the colouring so generally characteristic of *Cyclophorus* and its allies, these species have a peculiar olivaceous epidermis, highly polished in two of the species, much as in *Pupina* and the allied genera, while in the third form the shell has a silky appearance, due to minute striation. Another peculiar character is the constant occurrence of two keels, one just at the periphery, the other at or near the base of the shell, the two being separated by a smooth space. Other spiral sculpture is found in two of the species, but these two keels are the most conspicuous; less so, however, in *Cyclophorus Beddomei*, than in the other forms. The operculum in all three species, closely resembles that in the Burmese type of *Pterocyclos*. It is horny and double, with the edges of the whorls composing it free, and is surrounded by a marginal groove between the free edge of the outermost whorl, and that of the inner membranaceous lining of the operculum. It differs from the *Pterocyclos* opercula in being concave externally, instead of flat or convex. Too much importance, however, must not be assigned to these minute characters of the operculum.

The new section appears to me quite as distinct from *Cyclophorus*, as *Cyclotus* and *Leptopoma* are, and not quite so well distinguished as *Pterocyclos*; I, therefore, class it as a subgenus of *Cyclophorus*.

\* Printed in this number of the Journal by special order of the Council.

## DITROPIS.\* Subg. nov.

*Testa translucens, subvitrea, epidermide olivaceâ nitidâ instructa, carinis duabus, vel pluribus, unâ ad peripheriam, alterâ subtus ab illâ interspatio discretâ circumdata. Operculum corneum, arctispirum, duplex, laminâ internâ membranacê, externâ crassiusculâ, marginibus anfractuum liberis, ambabus sulco marginali disjunctis. Animal ignotum.*

Shell translucent, almost vitreous, covered with a smooth olivaceous epidermis, with two or more spiral ribs, one of which is always at the periphery of the last whorl, and a second below, separated by an interval from the other. Operculum horny closely wound, composed of two laminæ, separated by a marginal groove, the inner membranaceous, the outer rather thick, and with the edges of the whorls free. Animal unknown. Type, *Cyclophorus planorbis*, n. sp.

I have examined the lingual ribbon of one species. It only differs from that of *Cyclophorus* in the form of the lateral teeth, and in their denticulations being shorter and more numerous. In *C. (Ditropis) convexus*, the species examined, the central tooth has 7 denticulations, that in the middle being the largest: all the lateral teeth apparently had 5 denticulations, but it was very difficult to count those in the outermost laterals correctly.

1.—*Cyclophorus (Ditropis) planorbis*, n. sp.

Pl. XVI, fig. 1.

*Testa latissime umbilicata, depressa, discoidea, vitrea, tenuis, olivacea, glabra, obsolete striatula, polita. Spira plana, nucleo non exserto, sæpe eroso, sutura impressa, ad anfractum ultimum et supra et in umbilico costâ sublatâ intus marginata. Anfr. 4—4½, convexi; ultimus antice vix descendens sub-quadrangularis, supra atque subtus convexus, carinis duabus validis circumdatus, unâ ad peripheriam, alterâ juxta basin ad latus externum. Umbilicus perspectivus, omnes anfractus exhibens. Apertura obliqua, sub-quadrata intus albido-labiata; peristoma incrassatum, rectum, non-expansum. Operculum intus convexus, extus concavum, marginibus anfractuum externorum laciniatim elongatis. Exempli majoris diam. maj. 8½, min. 7, alt. 2, ap. diam. 1¾, millem.*

„ minoris „ 7 „ 5½ „ 1½ „ „ (fere) 1½ „

*Hab.* “Calcad hills,” ad fines provinciæ Travancore in Indiâ meri-

\* Etym. *δῖς*, twice; *τροπῖς*, a keel.

*dionali, haud procul a promontorio meridionali Indiæ "Cape Comorin" dicto.*

Shell very broadly umbilicated, depressed, discoidal, thin, glassy, smooth and polished, with obsolete striation. Spire perfectly flat; the apex not rising above the surface; suture impressed; the nucleus is generally wanting, being apparently remarkably liable to erosion. Whorls 4 to  $4\frac{1}{2}$ , slightly convex above, the last descending but slightly near the mouth, and nearly square, with two keels, the one rather high up, forming the periphery of the shell, the other at the outer side of the base; these keels can be traced upon the penultimate and part of the ante-penultimate whorl, both on the spire and within the umbilicus, forming a distinct rib inside the suture. Aperture oblique, nearly square, with a white internal lip; peristome thickened, all in one plane and not expanded. Operculum convex and smooth inside, the margins of the whorls externally much elongated and torn, especially towards the margin.

Major diameter, from the edge of the peristome to the opposite margin 0.34 inch, minor diam., at right angles to the other, 0.28, height 0.08. A smaller specimen measures 0.27 and 0.2 in the two diameters and 0.5 in height.

Although this shell resembles some *Cyclophori* in form, it differs from all species hitherto known in several characters and certainly forms the type of a distinct section.

## 2.—*Cyclophorus (Ditropis) Beddomei*, n. sp.

Pl. XVI, fig. 2.

*Testa latissime umbilicata, depressa, discoidea, tenuis, olivacea, confertissime striata, parum nitida, spiraliter costata. Spira plana, sutura valde impressa. Anfr. circa 4, (primo in exemplo unico deficienti) convexi, primi fere glabri; penultimus costis 2—3, supra und, infra in umbilico juxta suturam ornatus, ultimus antice descendens, teres, juxta suturam et subter peripheriam glaber, 7—costatus, costis 4 superioribus, quarum externa ad peripheriam, 3 basalibus ab superis intervallo disjunctis. Umbilicus perspectivus. Apertura diagonalis, rotunda; peristoma simplex, rectum, breviter adnatum, nigrescens, intus tenuiter albido-labiatum. Operculum fusco-corneum, intus convexum, limbo tenuissimo circumdatum, extus concaviusculum, marginibus anfractuum parum elevatis.*

*Diam. maj.* 8, *Min.*  $6\frac{3}{4}$ , *axis*  $2\frac{1}{2}$  millem., *ap. diam. intus* 2.

*Hab.* Travancore.

Shell very widely umbilicated, depressed, discoidal, thin, olive-coloured, very closely and minutely striated, less polished than the other species, and covered with spiral ribbing. The spire is flat, or nearly so, but the innermost whorls being deficient in the only specimen sent for description by Major Beddome, it is impossible to say whether the apex is slightly exerted or not. The suture is much impressed. Whorls about 4 in number, convex; the last one descending near the mouth, smooth near the suture, both above and below, with 7 spiral ribs; 4 above, the outermost forming the periphery of the shell, and 3 below, separated from the others by a smooth space; 3 of the upper and 1 of the lower can be traced on the penultimate whorl near the suture, but become obsolete on the inner whorls. The umbilicus exposes all the whorls below. Aperture diagonal, round, peristome only joined for a very short distance to the penultimate whorl, thickened, all in one plane and not expanded, faintly edged with white inside, blackish externally.

The operculum differs from that of *Cyclophorus planorbis* by the edges of the whorls being less produced externally, and by its being in consequence less concave. Major diameter 0.31 inch, minor 0.27, axis 0.9.

This species recently found by Major Beddome in the Travancore hills, is easily distinguished from the last species by its numerous spiral ridges, and by the absence of the glassy surface, so characteristic of both the other species. But two specimens have been found, of which I have only seen one.

### 3.—*Cyclophorus (Ditropis) convexus*, n. sp.

Pl. XVI, fig. 3.

*Testa aperte umbilicata, depresso-convexa, tenuis, nitida, vitrea, glabra, olivacea, minutissime et obsolete decussato-striatula. Spira convexa; apice obtuso; sutura impressa intus marginata. Anfr. 4, convexi; ultimus versus aperturam paulum descendens, teres, juxta suturam fasciâ latâ fuscâ pictus, extus pallidior, carinâ unâ validâ ad peripheriam, alterâ ad basin circumdatus; umbilico perspectivo, omnes anfractus exhibens, confertim spiraliter liratus. Apertura obliqua rotunda; peristoma rectum simplex, incrassatum atque continuum. Oper-*

*culum fusco-corneum, per-simile illi Cyclophori planorbis, marginibus externis anfractuum laciniatim productis.*

*Diam. maj.*  $6\frac{1}{2}$ , *min.*  $5\frac{1}{2}$ , *axis*  $3\frac{1}{2}$  millem. *ap. diam. intus*  $2\frac{1}{4}$ .

*Hab.* Cum *C. planorbo* in montibus Calcad Hills dictis.

Shell openly umbilicated, depressly convex, thin, smooth, shining, glassy, of an olive colour, with minute sub-obsolete decussating striae, only visible beneath a powerful lens. Spire convex, apex obtuse, suture impressed and with an internal margination, due to the prolongation on the inner whorls of the keel surrounding the shell. Whorls 4, convex; the last descending slightly near the aperture, and becoming paler in colour in front on the outer half of the surface only, so that a band of darker colour surrounds the shell close to the suture. Of the two keels one is at the periphery, and rather lower in position than usual, owing partly to the raised spire, the other is at the base, rather towards the umbilicus, which exhibits all the whorls, and is closely spirally ribbed inside. Aperture round, oblique, peristome in one plane, simple, thickened. Operculum very similar to that of *Cyclophorus planorbis*, with the external edges of the whorls lengthened, ragged and split up into a fringe-like edge. Major diameter 0.26, minor 0.22, axis 0.14 inch.

This very beautiful little species has much more of the character of *C. (Ditropis) planorbis* than of *C. Beddomei*, having the same glassy structure and high lustre. The convex form is peculiar and very unusual amongst the *Cyclophoridæ*.

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The next two species are at least equally peculiar with the last three, and I was for some time much puzzled as to their position amongst the *Cyclophoridæ*, until more close examination of the operculum, revealed its peculiar structure and its resemblance to that of *Opisthoporus*. Mr. Benson, some years ago, proposed that should other species be found, resembling *Opisthoporus* in the characters of the operculum, but wanting the sutural tube, they should be classed with the typical forms under the name *Cælopoma*.\* This remark, however, was especially intended to apply to *Cyclotus variegatus* and its allies, with which the types of *Opisthoporus* had been classed by Dr. Pfeiffer. In point of fact, the sutural tube of *Opisthoporus* is

\* Ann. and Mag. Nat. Hist. for 1855, Ser. 2, Vol. XV. p. 15.

a generic character of higher importance than the structure of the operculum, so much so, that I believe, as I pointed out in 1864,\* that *Opisthoporus* can only rank as a sub-genus of *Spiraculum*, Pearson, which has a totally different operculum but a similar sutural tube. The similar structure of the operculum in the species lately discovered in the hills of Southern India, by no means serves to prove any very close affinity to *Opisthoporus*, since the characters of the shell are totally distinct. With the exception of the absence of the sutural tube, this is not the case with *Cyclotus variegatus* and its allies. I do not think the present forms would have been classed by Mr. Benson in the same genus as *Opisthoporus*, and as I am inclined, after a good deal of study of the *Cyclophoridae*, to consider the opercula alone as quite insufficient for the foundation of generic groups, and to attach far less importance to their characters than has hitherto been done by Mr. Benson and Dr. Pfeiffer, I am even less disposed to class together dissimilar shells solely on account of the opercular structure than those naturalists are.

The operculum of the new genus appears to me, despite its resemblance to that of *Opisthoporus*, to be a modification of a slightly different type. That of *Opisthoporus* is produced by variation of the typical *Cyclotus* operculum, but with less closely connected whorls. That of the genus now proposed, I consider a modification of the *Cyathopoma* operculum, in which the calcareous outer edges of the whorls, instead of being merely slightly curved towards the centre and free, are so much more curved that the outer edge of each joins the next interior one. Another modification of the same occurs in *Jerdonia*, in which the same outer edges are lamelliform and flat, each overlapping the inner one.

Undoubtedly all these numerous forms of *Cyclophoridae* are very puzzling. The types of land Mollusca are after all few compared with those of most other forms of terrestrial animal life, and the tendency to variation amongst them is excessive, and in the *Cyclophoridae* especially; the operculum has evidently become a very variable portion of the organism. It is very difficult to determine, in a case like the present, whether it is wise to found a new group or not. Still the two shells now to be described differ so much from all other

\* Ann. and Mag. Nat. Hist. Ser. 3, Vol. XIII. p. 451.

known forms in the combination of characters presented, that such appears the only course open, and as will be seen presently, the characters of the lingual dentition fully bear out the separation.

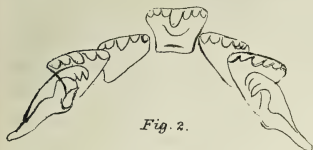


Fig. 2.

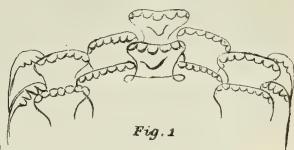


Fig. 1

*Cyclophorus (Ditropis) convexus.*

*Mychopoma limbiferum.*

*MYCHOPOMA*\* gen. nov.

*Testa in speciebus notis turbinata epidermide fuscâ, crassâ, hirsutâ induta. Apertura intus corrugata. Operculum simile ei generis Opisthopori, e duobis discis multispiris, parallelis, interno membranaceo, externo calcareo compositum; laminâ spirali erectâ interpositâ, interspatiis vacuis.*

Shell, in the two species hitherto known, turbinate, covered with a thick dark-coloured epidermis, more or less hairy. Aperture crenulated within. Operculum very similar to that of *Opisthoporus* in structure, composed of an external calcareous and an internal membranaceous layer, both multispiral and united by a spiral lamina at right angles to them, the spaces between the whorls of which are vacant. The operculum is flat or nearly so, rather thick, and with a marginal sulcation.

Of this type also I have examined the lingual dentition of one species, *M. limbiferum*. The central tooth much resembles that of *Cyclophorus* in form, but it has 7 nearly equal denticulations. The inner lateral teeth are much broader, and differently placed from those in any other *Cyclophoridae* which have been, so far as I know, examined. They also have 7 denticulations, and the same appears to be the case in the outermost laterals, on which, however, it is difficult to count the exact number. These outermost teeth differ greatly in form and position from the usual type amongst the *Cyclophoridae*, and rather resemble those of *Paludina* or *Valvata*.

\* Typus *M. hirsutum*, Beddome, MS. Etym. *μυχος* an inner chamber, *πομα* operculum.

4.—**Mychopoma hirsutum**, Beddome, MS. Pl. XVI, fig. 5.

*Testa mediocriter umbilicata, depresso-turbinata, solidiuscula, epidermide crassâ, fuscâ, liris spiralibus sub-confertis et lineis elevatis confertissimis obliquis decussatim ornatâ; intra suturam, ad peripheriam, atque circa umbilicum pilis longiusculis confertim fimbriata induta; sub epidermide albida, decussato-costulata, liris spiralibus plus obliquis, minus validis quam extra epidermidem. Spira convexo-conoidea; apice prominulo, papillari; sutura profunda, pilis fere oblecta. Anfr. 5—5½ convexi, ultimus teres, antice parum descendens. Umbilicus perspectivus, omnes anfractus exhibens, fimbriâ hirsutâ partim celatus, intus spiraliter liratus. Apertura diagonalis, rotunda, intus sublactea atque lineis horizontalibus fuscis signata; peristoma sinuatum, duplex, extus expansiusculum crispatum, intus corrugatum, margine columellari repando, solo, glabro et simplice. Operculum multispirum, crassum, extus concaviusculum, calcareum, albidum, intus planum membranaceum. Diam. maj. 8½, min. 7, axis 5½, ap. diam. intus 3½ millem.*

*Hab. In montibus Calcad atque Myhendra dictis, in regione Travancorica Indiæ meridionalis.*

Shell umbilicated, depressly turbinated, rather solid, covered with a thick dark coloured epidermis, which has strong raised decussated sculpture of spiral ridges and very close oblique costulation: at the periphery and around the umbilicus there is a fringe of close, rather long hairs, and the outer series continued on the inner whorls forms a sutural fringe also. Beneath the epidermis the shell is white with decussating lines, the spiral sculpture being more pronounced and the ribbing corresponding to the lines of growth less so than outside the epidermis. Spire convexly conoid, the apex prominent and papillar, suture deep, nearly concealed by the hairy fringe within. Whorls 5—5½, convex, the last cylindrical, descending but very little in front. Umbilicus pervious, exhibiting all the whorls, spirally ribbed, partly covered by the surrounding hairy fringe. Aperture diagonal, round, rather milky inside, with dark horizontal lines corresponding to the spiral ribs on the shell; the peristome is thick and double, curved backwards near the umbilicus, the internal portion with minute pearly white denticulations, largest on the outer (dextral) margin and gradually decreasing slightly in size on the upper and basal edges, vanishing entirely near the umbilicus; the external peristome

is slightly expanded, the edge cut into minute teeth like those of a saw except on the inner or columellar margin. Operculum externally slightly concave, white, calcareous; the spiral sculpture obsolete near the centre in old specimens; internally membranaceous. Major diameter 0.34, minor 0.28, axis 0.22, diameter of the aperture 0.14 inch.

This is a very curious and interesting species which, while differing in many respects from any known form, has marked affinities with shells belonging to distinct groups. Had the shell been discovered without the operculum, there could have been very little hesitation in considering it a large form of *Cyathopoma*; the sculpture and general shape are precisely those of the types of that genus, and in some species, as *Cyathopoma filocinctum*, there is a thick epidermis, and also the very singular internal crenulation of the mouth, which is more marked in the present shell than in any allied species. The operculum, however, is totally different: instead of the whorls having the curious raised and incurved edges so characteristic of *Cyathopoma* they are flat and almost obsolete near the centre, on the outer surface, being far less distinct than in typical species of *Cyclotus*.

The hairy fringe around both the periphery and the umbilicus so closely resembles that in *Cyclophorus* (*Craspedotropis*) *cuspidatus*, Bens., that there can be no question of a certain affinity between the two species, and there is considerable resemblance in their general form. The apertures, however, differ greatly, and there are marked distinctions in the operculum.

On the whole, I think it highly probable, that the present generic type, and perhaps *Craspedotropis* also, will finally have to be considered as sub-genera of *Cyathopoma*.

#### 5.—*Mychopoma limbiferum*, n. sp. Pl. XVI, fig. 4.

*Testa anguste umbilicata, turbinata, tenuis, epidermide deciduâ, fulvâ, strigis fuscis, obliquis spiralibusque notatâ, vel unicolori fuscâ, fimbriam pilorum brevium circa umbilicum ferente, induta; sub epidermide albida, iris confertis spiralibus ornata. Spira conica; sutura valde impressa. Anfr. 5½ convexi, ultimus teres, antice sub-descendens. Apertura obliqua, fere circularis: peristoma duplex; externum limbo sub-late expanso circumdatum, ad angulum aperturæ antice porrectum; internum vix discretum intus sub-distanter corrugatum; margine columellari amborum valde repando, glabro, vix expansiusculo. Operculum minus crassum*

*quam in M. hirsuto, extus concaviusculum, laminâ calcareâ ad centrum carente, intus planum.*

*Exempli majoris diam. maj. 7, min. 6, axis  $5\frac{1}{2}$ , ap. diam. intus  $2\frac{3}{4}$ , millem.*

„ *minoris* „  $5\frac{1}{4}$  „  $4\frac{1}{2}$  „  $4\frac{1}{4}$  „ *intus 2* „

*Hab. In summis montibus Pulney dictis; detexit S. Fairbank.*

Shell narrowly umbilicated, turbinate, thin, covered with a thick deciduous, yellowish brown epidermis, with dark spiral and oblique stripes, or more frequently perhaps altogether dark brown, with a fringe of short hairs round the umbilicus: beneath the epidermis, the shell is white with close spiral sculpture. In some specimens, as in *M. hirsutum*, there are oblique raised lines outside the epidermis, but they are not always conspicuous. Spire conical, suture deep. Whorls  $5\frac{1}{2}$  convex, the last cylindrical, scarcely descending towards the aperture which is oblique and nearly circular. The peristome is much curved back, near the umbilicus, where it is almost simple and scarcely expanded: elsewhere the outer portion is sharply reversed, forming a broad rim at right angles to the axis of the whorl on the outer and basal margins, while near the penultimate whorl, it is produced in front. The inner portion of the peristome scarcely projects beyond the outer; it is corrugated within, but not nearly so closely or strongly as in *M. hirsutum*, and the corrugation is very faint towards the base, and entirely wanting at the angle of the aperture and on the collumellar margin. Operculum thinner than in the last species, and the calcareous external portion less developed, and entirely wanting at the centre.

Major diameter in a large specimen 0.28 inch, minor diameter 0.25, axis 0.22, diameter of the aperture inside 0.11. Of a small specimen, the respective measurements are 0.21, 0.165, 0.16 and 0.08.

This is a very different shell from the last, being much higher in the spire with a broader edge to the mouth. The name is taken from the last peculiarity. Only a few specimens were found by Mr. Fairbank. It appears to inhabit the tops of the Pulneys at a height of about 7,000 feet.

## 6.—*Pterocyclos ? tristis*, n. sp. Pl. XVI, fig. 9.

*Testa late umbilicata, depressa, tenuis, epidermide crassâ, fulvescenti-brunneâ induta; sub epidermide albida, striatula. Spira convexa. Apice parum exserto, per-obtusio, suturâ profundâ. Anfr. 5 rotundati; ultimus teres, longe sensim descendens. Apertura obliqua, rotunda;*

*peristoma brevissime adnatum, duplex; internum parum porrectum, superne juxta suturam vix sinuatum; externum leviter expansum, continuum, a peristomate interno sulco discretum, supra ejus sinum in alam verticalem parvam, instar tubuli imperfecti, antice spectantem anfractum penultimum non attingentem, breviter cucullatim productum. Operc? Diam. maj.  $19\frac{1}{2}$ , min. 16, axis  $9\frac{1}{2}$ , mill. Ap. diam. intus  $6\frac{1}{2}$ .*

*Hab. In provinciâ South Canara; detexit H. Beddome.*

Shell widely umbilicated, depressed, thin, covered with a thick, olivaceous brown epidermis; beneath the epidermis white, faintly striated. The epidermis is closely rugately striated near the suture. Spire convex; apex scarcely exerted, obtuse; suture deep. Whorls 5, rounded, the last cylindrical, descending very gradually for a considerable distance behind the aperture. Mouth oblique, circular; peristome double, the two portions divided by a groove; the inner slightly projecting, with a very small, almost obsolete sinus above, close to the suture; the outer a little expanded, and produced above into a short vertical wing, opening in front, and forming an imperfect tube; it is just above the imperfect sinus in the inner peristome, and does not touch the penultimate whorl. Operculum unknown. Major diameter 0.8, minor 0.62, axis 0.36; diameter of the aperture 0.26 inch.

In the absence of the operculum, it is not easy to say if this shell should be classed as *Cyclophorus* or *Pterocyclos*. It might even be a *Rhiostoma*, and would in that case be another instance of the occurrence on the Malabar coast of Burmese and Malay forms, unknown elsewhere throughout the Indian Peninsula. In the extremely small wing not touching the penultimate whorl, the absence of a deep incision in the interior peristome beneath the wing, the large mouth, and uniform colouring, the species differs from all Indian forms of *Pterocyclos*. There can be no question of its being distinct also from all known forms of *Cyclophorus*, but, except for the wing, it approaches very nearly to *C. ravidus*, Bens., and *C. annulatus*, Trosch., both of which, however, are flatter.

#### 7.—*Spiraculum Fairbanki*, n. sp.

*Testa late umbilicata, depressa, sub-discoidea, decussatim striata, griseo-albida, irregulariter castaneo-strigata et maculata, fasciâ inter-*

*rupta sub-peripheria aliâque lata in umbilico castaneis. Spira fere plana; apice prominulo papillari; sutura valde impressa. Anfr. 5 rotundati; ultimus teres, antice sensim descendens, spiraculo brevi sub-verticali truncate-conico, cum anfractu penultimo conjuncto, 4 mill. pone aperturam sito munitus. Apertura diagonalis, circularis; peristoma duplex; internum breviter porrectum obtusum, ad suturam angulatim sinuatum; externum continuum expansum, supra sinum instar alæ cuculliformis, anfractui penultimo appressæ exstans, versus basin columellæ processum linguiformem emittens. Operculum corneum, intus valde concavum, extus convexum, apice planulato, marginibus anfractuum lamelliferis. Diam. maj.  $14\frac{1}{2}$ , min.  $11\frac{1}{2}$ , axis 6, ap. diam. intus 4 mill.*

*Hab. In montibus Pulney dictis, Indiæ meridionalis. S. Fairbank.*

Shell broadly umbilicated, depressed, nearly discoidal, greyish white with irregular streaks and spots of chesnut and two bands of the same colour; one, somewhat interrupted, below the periphery, the other, broader, within the umbilicus. Spire almost flat, the apex prominent and papillar, the suture deeply impressed. Whorls 5 rounded, the last cylindrical, gradually descending in front and furnished, (0.16 inch behind the aperture), with a short nearly vertical spiracle, in the form of a truncated cone, and joined to the penultimate whorl. Aperture diagonal, circular, the peristome double, the internal portion projecting slightly and obtuse, with a rather shallow angular sinus near the suture: the external peristome is continuous, expanded, dilated above into a projecting wing which runs forwards for some distance along the last whorl in front of the aperture, and is bent downwards at the end. Near the base of the columellar margin there is a small gutter-shaped projection. The operculum is very concave within, externally convex, flattened at the apex, with free lamellar edges to the whorls as in the typical species of *Pterocyclos*. Major diameter 0.58, minor 0.47, axis 0.23, diameter of the aperture within 0.16 inch. A rather smaller specimen measures 0.64 by 0.52 in its two diameters.

This species has not been figured as I hope to be able to give illustrations of all the known forms of *Spiraculum* on one plate.

The genus *Spiraculum*, previously to Mr. Fairbank's discovery, was not known to occur in Southern India. Its detection serves to

add another to the Burmese and Malay forms represented in the hill groups of that region. In 1866, I described another species, *Sp. Beddomei*\* from the Eastern hills near Vizagapatam (J. A. S. B. Vol. XXXV. Pl. II. p. 31). The present form differs from *Sp. Beddomei* in several characters, the principal being the prominent apex, the form of the sutural tube and the presence of a small lingui-form process at the left side of the peristome near its base. The last character indeed is quite peculiar, and serves alone to distinguish the present species. In size, and somewhat in form, there is a decided resemblance to the Burmese *Sp. Avanum*, in which, however, there are not only important distinctions in the form of the peristome, the recurved sutural tube, &c., but the operculum is also very different, being flat precisely as in the Burmese forms of *Pterocyclos*, while in *Spiraculum Fairbanki*, it is as convex as in *Pterocyclos rupestris*, or *Pt. bilabiatum*.

Mr. Fairbank only obtained 11 specimens of this interesting form. They were found in a Shola at some distance from Kodai Kanal, the hill station on the Pulneys, on the road to the Kukal Shola.

#### 8.—*Cataulus Calcadensis*, Bedd. MS. Pl. XVI, fig. 8.

*Testa sub-perforata, fusiformi-turrita, solida, confertim sub-sinuate costulata. Spira ovato-turrita; apice acutiusculo; sutura valde impressa. Anfr. 8½, convexi, ultimus parum angustior, demum breviter solutus, antice porrectus vix descendens, carinâ basali validâ, compressâ, costulatâ, antice dilatatâ munitus; periomphalo mediocri, costulato. Apertura sub-circularis, fere verticalis, canali ad latus sinistrum marginis basalis patente, ore subtus dextrorsumque spectante; peristoma incrassato-expansum, sub-duplex vel duplex, internum obtusum, externum expansum, revolutum, postice et ad canalem basalem productum, margine columellari insuper angustiori, cum anfractu penultimo haud juncto. Opere?*

Long. 21, diam. 7, apert. diam. intus  $3\frac{1}{2}$  millem. Apertura cum peristomate incluso canali  $6\frac{1}{2}$  millem. longa. Exempli minoris long. 16, diam. cum perist.  $5\frac{3}{4}$ , diam. minor 5, apert. intus 3 millem.

*Hab.* 'Calcad Hills' extra fines provinciæ Travancore.

Shell sub-perforate, fusiformly turritid, solid, closely and rather

\* In the habitat of this shell, there is a misprint. *Kimery* hills should be *Kimety* hills.

sinuously costulated. Spire ovately turritid, apex rather acute, suture much impressed. Whorls  $8\frac{1}{2}$ , convex, the last a little smaller, quite free from the other whorls for a short distance behind the mouth, but not descending much, not nearly so far as *C. tortuosus* is represented as doing. The basal keel is strong, compressed, transversely ribbed, and becoming larger in front; the space inside the keel around the umbilicus is of moderate size and ribbed. Aperture nearly circular, and almost vertical, the opening of the basal canal being at the left side and not in the same plane as the aperture, but turned a little downwards and to the right. Peristome thickened double, the inner portion obtuse, the outer expanded, turned back, produced below the canal and above near the suture, narrower on the inner margin and not touching the penultimate whorl. Operculum unknown. Measurements of 3 specimens in decimals of an inch.

| Length, | Major diameter,     | minor diameter, | width of         |
|---------|---------------------|-----------------|------------------|
|         | peristome included, |                 | aperture inside, |
| 0.84    | 0.28                |                 | 0.14             |
| 0.76    | 0.26                | 0.23            | 0.14             |
| 0.64    | 0.23                | 0.2             | 0.12.            |

Length of the aperture and outer peristome in the larger specimen from the base of the canal to the end of the projection above 0.26 inch.

At first sight, this shell bears a most striking resemblance to *C. tortuosus*, Chem., but the last whorl is much less produced, and there appear, judging from the description and figures of Chemnitz's species, to be several slight but not unimportant distinctions in sculpture and form. Amongst the Ceylonese species, the nearest approach to the present is made by *C. decorus*, Bens., and *C. Blanfordi*, Dohrn, but no Ceylonese kind is known with the last whorl free. The previously described *Cataulus* from the base of the Anamullay hills resembles *C. Calcadensis* in the sinistral position of the keel, a character not noticed by Pfeiffer in his description.

Since finding the present species I learn from Captain Beddome that he has met with a third Indian *Cataulus* in Travancore.

So far as I am aware, the Nicobar locality of *Cataulus tortuosus* has not been confirmed. The discovery of so closely allied a form as that now described, in Southern India tends to make it probable that the

species described by Chemnitz may prove to be Indian. Two other shells attributed by Chemnitz to the Nicobar Islands, *Helix hæmastoma*, L., and *H. Nicobarica*, Chem., have not since been brought thence. It is just possible that the former may occur, though I cannot help thinking it improbable, but as the locality for *Helix Nicobarica* is now distinctly ascertained to be the neighbourhood of Cuddapah, far inland and amidst a fauna and flora which resembles that of the Cape of Good Hope nearly as much as it does that of the Nicobar Islands, I utterly disbelieve in the occurrence of the species in the latter locality. The fact that both *Helix Nicobarica* and *H. hæmastoma* are Indian or Ceylonese, tends to increase the probability of *Cataulus tortuosus* being also an Indian shell.

### 9.—*Opisthostoma macrostoma*, Beddome, MS.

Pl. XVI, fig. 7.

*Testa perforata, conoideo-ovata, albida vel pallide rubella, subdistanter oblique filiformi-costulata, sub lente spiraliter minutissime et confertissime striata. Spira elevato-conoidea, lateribus convexis; apice acutiusculo; sutura valde impressa. Anfr. 5½, convexi, apicales normales non-diviantes, penultimus vix major, ultimus confertius costulatus, brevissime constrictus, antice sigmoideo-deflexus. Umbilicus ab anfractu ultimo non-occultus. Apertura retrorsa sub-rotunda, fere verticalis; peristoma brevissime ad anfractos duos, penultimum et ante-penultimum, adnatum, duplex, internum continuum expansiusculum, externum, expansum breviter interruptum. Long. 3, diam. major 3, min. 2 millem. Ap. diam. cum perist. 1½ millem.*

*Hab. In montibus Bramagiri dictis, in regione Wynaad, haud procul a littore Malabarica Indiæ. H. Beddome detexit.*

Shell perforated, conoidly ovate, white or pale reddish in colour with sub-distant oblique filiform costulation, which becomes closer on the last whorl: beneath a microscope there is very fine close spiral striation, very difficult to detect in general, as in other species of *Opisthostoma* and many *Diplommatinæ*.\* Spire elongately conoid with convex sides, the apex rather acute, suture deep. Whorls 5½ convex, the apical ones not excentric as in the other Indian species; the penultimate whorl very little larger than those above it. The last whorl is constricted as usual. In front of the constriction it is

\* In a good light it may easily be detected in *O. Crespigni*, H. Ad.

deflected inwards, but less sharply so than in *O. Fairbanki*, and it does not conceal the umbilicus, the curve being more as in *O. Nilgircum*. Aperture reversed, nearly circular, almost vertical, having scarcely any inclination upwards. Peristome attached for a short distance only, touching both the penultimate and ante-penultimate whorls, double, both portions expanded, the outer more broadly reflexed, and interrupted for a short distance where attached, inner peristome continuous. Length 0.12, breadth measured across the peristome 0.12, shorter diameter 0.8, breadth of the aperture including the peristome 0.6 inch.

This is the largest form of the genus yet met with, exceeding even the Labuan species *O. Crespigni*, H. Ad. It is much more pupa-shaped than that kind is, but much less so than the two previously described Indian forms, from both of which it may easily be distinguished by the apical whorls not being excentric, as well as by its much greater size.

As the figure of *O. Fairbanki* in the Proceedings of the Zoological Society for 1866, Pl. XXXVIII, is rather too small to give a good idea of the form, and the sculpture had been omitted, two figures are given in the plate belonging to this paper, figs. 6, 6 a. For the drawings I am indebted to the kindness of Captain Godwin Austen. In fig. 6 a, representing the shell from below, the view is a little from the side; when seen from beneath in the line of the axis, the umbilicus is completely concealed by the last whorl, a character peculiar to *O. Fairbanki*.

From the figure just referred to in the Proceedings Zoological Society, the idea is conveyed that *Opisthostoma Fairbanki* is a much smoother species than *O. Nilgircum*. This is due to the accident that the draughtsman had only the former species before him, and copied the figure of the other. In reality, the sculpture is about equally strong on both forms, the only difference being, that it is a little closer in *O. Nilgircum*.

In the 3rd supplement to Dr. Pfeiffer's monograph of the *Helicidae* just published, I see with some surprise that he retains H. Adams' genus *Plectostoma*. The author of that genus admitted in the Proceedings of the Zoological Society for 1865, p. 755, that it was identical with *Opisthostoma*, and subsequently in the Proceedings Zoological

Society for 1866, p. 447, announced the discovery of the operculum, as I had anticipated.

10.—**Ennea sculpta**, n. sp. Pl. XVI, fig. 10.

*Testa profunde et flexuose rimata, sub-cylindrica, solidula, cerea, diaphana, nitida, costis verticalibus sub-flexuosis ornata. Spira turrita, sursum vix attenuata; apice obtuso; sutura impressa. Anfr. 8, primi 2 levigati, ceteri sub-confertim costulati, ultimus  $\frac{1}{4}$  longitudinis fere æquans, antice sub-ascendens, basi compressus. Apertura verticalis, truncato-ovata, lamellâ unâ parietali intrante juxta angulum, aliis profundis 4 palatalibus, secunda minori, unâ columellari valida torta, in apertura vix conspicuâ, coarctata. Peristoma undique expansum, albidum, ad basin late repandum, marginibus callo lamelliferi junctis. Long.  $8\frac{1}{2}$ , diam.  $2\frac{1}{2}$ , millem. Ap. cum perist. 2 mill. longa.*

*Hab. In montibus Pulney, Indiæ meridionalis, detexit S. Fairbank.*

Shell deeply and flexuously rimate, sub-cylindrical, rather solid, translucent with a low glossy lustre and of the colour of wax. Spire turrit and elongate, becoming very little smaller above and bluntly terminated at the apex; suture impressed, whorls 8, the first two smooth, the others with strong vertical sub-flexuous ribs, the last whorl ascending slightly in front, compressed at the base. Aperture vertical, truncately oval, with a re-entering parietal plait close to the angle, a very deep columellar fold, scarcely perceptible from the aperture, but strong and twisted within, running up till it nearly joins the parietal plait, and 4 palatal lamellæ, the second of which from above is very small. These, like the columellar fold, are situated so far back, that they are with difficulty to be made out from the aperture. Peristome white, expanded, curved back slightly near the base, margins united by a rather thick callus on which is the parietal lamella. Length 0.34, diameter 0.1, length of aperture, peristome included, 0.08 inch.

This form has some slight resemblance to *E. Pirriei*, Pir., but has very much stronger sculpture, and the lamellæ around the aperture, are very different.

I have another *Ennea* from the Nilgiris which I have hitherto considered a small variety of *E. Pirriei*, but it appears to differ in the possession of a strong transverse basal plica. In both forms, young specimens appear to have the lamellæ of the aperture quite

as well developed as adults, so that they must be formed and re-absorbed, as I have shewn to be the case in the *Plectopylis* section of *Helix*: Ann. and Mag. Nat. Hist. Ser. 3, Vol. VII. p. 244. Pfeiffer—Mon. Vol. IV. p. 342,—describes the occurrence of the columellar plicæ in the young of *E. Pirriei*.

11.—**Streptaxis Canarica**, Beddome, MS. Pl. XVI, fig. 11.

*Testa umbilicata, depressa, ovata, cerea, nitidula undique flexuose capillaceo striata. Spira convexa; apice obtuso; sutura vix impressa sub-marginata. Anfr. 5½, parum convexi, penultimus postice acute carinatus, ultimus valde antrorsum devians, post aperturam fossiculis brevibus tribus constrictus, subtus convexus, ad basin circa umbilicum compressus. Apertura obliqua, irregulariter semiovata, lamina unâ parietali torta valida et dentibus sex in peristomate fere æquidistantibus coarctata. Peristoma albidum, undique sub-late expansum, ad angulum sinuatum, marginibus callo lamelliferi junctis. Diam. maj. vix 8, min. 5½, alt. 3½ mill; apert. cum perist fere 3 mill. longa, 2¾ lata.*

*Hab. In Provincia South Canara, haud procul a littore occidentali Indiæ.*

Shell umbilicated, depressed, ovate with considerable lustre and the colour of wax, with close rather irregular and flexuous hair-like striation both above and below. Spire convex, apex obtuse, suture scarcely impressed, sub-marginate. Whorls 5½, very little convex, the penultimate sharply keeled on the side opposite to the aperture, last whorl very excentric, with three distinct depressions behind the peristome; compressed beneath, especially near the mouth. Aperture oblique, irregularly semi ovate, with 7 teeth; 1 lamelliform doubly curved and re-entering for a short distance on the callus, uniting the margins of the peristome, and 6 in the peristome itself nearly equidistant from each other: of these two are on the outer margin, one at the curve where the peristome bends round towards the umbilicus, and 3 along the inner, or columellar, margin. The two lowest of the latter are the closest together of any. Peristome white, expanded, curved back considerably close to the junction with the last whorl. Major diameter 0.32, minor 0.22, height 0.14 inch, aperture 0.12 inch long, 0.11 broad.

This is the first strongly keeled species which has been met with in India. In form it much resembles the Molmain *S. Sankeyi*, Bens.

The sculpture is peculiar. But a single specimen has been obtained by Major Beddome.

*Cyclophorus ravidus*, Bens., has been found by Major Beddome, on the Anamullay hills, and in the Wynaad. In both localities it attains a considerably larger size than the type. The Annamullay form is 27 millimeters by 22, that from the Wynaad, 24 mill. by 19½. The operculum, when in good condition, has raised margins to the whorls. I am inclined to consider the species identical with the Ceylon *C. annulatus*, Troschel.

*Auricula nitidula*, described in No. VIII of these contributions, J. A. S. B. Vol. XXXVI, Part II, p. 64, proves to be a variety of *A. Gangetica* of Benson, with a thicker and darker coloured epidermis, but not otherwise differing. The dark coloured variety occurs also in the Ganges delta, where it has been found by Dr. Stoliczka.

#### EXPLANATION OF PLATE XVI.

Fig. 1, 1 a, 1 b, *Cyclophorus (Ditropis) planorbis*, W. Blanf., magnified 2 diameters.

„ 2, 2 a, 2 b, *C. (Ditropis) Beddomei*, W. Blanf., ditto.

„ 2 c, Operculum of ditto ditto.

„ 3, 3 a, 3 b, *C. (Ditropis) convexus*, W. Blanf., ditto.

„ 4, 4 a, 4 b, *Mychopoma limbiferum*, W. Blanf., ditto.

„ 4 c, 4 d, Operculum of ditto ditto.

„ 5, 5 a, 5 b, *M. hirsutum*, Beddome, ditto.

„ 5 c, 5 d, Operculum of ditto ditto.

„ 6, 6 a, *Opisthostoma Fairbanki*, W. Blanf., magnified 10 diameters.

„ 7, *O. macrostoma* Beddome, magnified 4 diameters.

„ 8, *Catulus Calcadensis*, Beddome, natural size.

„ 9, 9 a, *Pteroryclos tristis*, W. Blanf., natural size.

„ 10, *Ennea sculpta*, W. Blanf., magnified 2 diameters.

„ 11, 11 a, 11 b, *Streptaxis Canarica*, Beddome, ditto.



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## PART II.—PHYSICAL SCIENCE.

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No. III.—1869.

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*Remarks on the species of Pandanus ; by S. KURZ, Esq., Curator of the Calcutta Herbarium.*

[Received and read, 4th November, 1868.]

Since the publication of my revision\* of Indian screw-pines, and their allies, in Seemann's Journal of Botany, Vol. V. p. 93 etc., I had the opportunity of consulting Gaudichaud's work, "Voyage autour du monde sur la Bonite," and this gives me an opportunity for a few additional remarks.

Although I am at present unable to recognize several of Gaudichaud's species, the study of the carefully executed plates of this work have considerably added to my knowledge of screw-pines. From the analyses of *Freycinetia* and *Sussea* it appears quite clear, that the *Pandaneæ* and *Freycinetieæ* cannot be separated from each other, as

\* In this paper some errors and omissions have crept in, which I now take the opportunity of correcting.

*Typha elephantina* p. 95, read: folia ... basi triquetra lateribus concavis, supra plana; instead "excavato-trigona."

II. *Pandaneæ*, p. 94, add: Ovarium superum.

III. *Cyclantheæ*, p. 94, add: Ovarium inferum. The *Freycinetieæ* are to be transferred to II, *Pandaneæ*.

*Pandanus furcatus*, var. *Indica*, p. 102, read: drupae valde convexae, for "concavae."

*Pandanus laevis*, p. 127, read: spadix masc. etc., sed hae laevissimae, instead "brevissimae."

I have formerly believed, having lain too much stress upon the number and the position of the ovules. Gaudichaud's genus *Sussea*, and especially *Souleyetia Freycinetioides* make it now even difficult, to retain *Pandanus* and *Freycinetia* as distinct genera. The only differences of some value, to distinguish them, seem to rest in the general habit, and the more or less regular superposition of the pendulous ovules along the marginal placenta. The ripe seeds in *Freycinetia* seem all to be furnished with a black and hard testa, while in *Pandanus*, they are only covered by a white membrane.

In revising Gaudichaud's species, I am now able to rectify my sections, formerly proposed, and I do this in recapitulating at the same time all the legitimate species, but omitting all those dubious ones, which have been already enumerated in my above quoted paper. It is impossible to form a correct idea, how far several of Gaudichaud's species of *Pandaneæ* are really identifications with Bory St. Vincent's Mascaren species, bearing homonymous specific names, as the plates are accompanied only by an incomplete explanation of the figures. My own idea is, that they are most probably respective identifications; Gaudichaud's *Roussinia Indica*, l. c. t. 21, at least, is a copy of Rheede's figures of *Perin Kaida* (*Pandanus unipapillatus*, Dennst.)

Dr. F. von Müller has recently published some notes on Australian *Pandaneæ*, mentioning therein two additional species of *Pandanus*, *P. aquaticus*, and *P. monticola*, F. Muell. (*Fragment. Phyt.*, V, p. 40). Unfortunately the names of these species are not accompanied by a description.

## PANDANUS, Rumph.

SECT. I. ACROSTIGMA. Drupae simplices; stigmata stricta, simplicia, spinescentia, extrorsum vergentes; filamenta libera; antherae acuminatæ; ovula solitaria. (*Fisquetia*, Gaud., ex parte.)

\* *Stigmata persistentia* (i. e. non nisi cum toto pericarpio separanda.)

1. **P. caricosus**, Rumph.; Kurz, in *Seem. Jour. of Bot.*, V, p. 100.

2. **P. affinis**, Kurz, loc. c., p. 101.

3. **P. foetidus**, Rxb., Kurz, loc. c., p. 101. *Fisquetia macrocarpa*, Gaud., Bot., Voy. Bonite, t. 4, figs. 2-8.

*P. ovatus* (*Fisquetia ovata*, Gaud., loc. c., t. 4, fig. 1,) seems to belong to this section.

\*\* *Stigmata secedentia*, (i. e. *imā basi fragilia*.)

4. **P. ornatus**, (*Fisquetia ornata*, Gaud., loc. c., t. 5, fig. 1, 8 et 9; et *F. militaris*, Gaud., ib. f. 2-7.)

I would have united this species with my *P. helicopus*, but Gaudichaud's plant has the peduncle below the syncarpe straight, while *P. helicopus*, in a young stage has it always spirally twisted, becoming afterwards lengthened and pendulous; also the serrature of the leaves are in Gaudichaud's figure much sharper.

5. **S. helicopus**. Kurz, loc. c., p. 101.

Of this species the male flowers are still unknown, and it is doubtful, therefore, whether it should be placed in *Acrostigma*, or rather form a distinct subsection of *Ryckia*.

SECT. II. RYCKIA. Drupae simplices; stigmata introrsum vergentes, secedentia, spinescentia, saepissime furcata, strictiuscula, v. a dorso depressa; filamenta racemosa, v. palmatum connata; antherae aristatae, v. apiculatae; ovula solitaria. (*Barrotia*, Gaud. ex parte.)

\* *Stigmata brevia*, a dorso plano depressa, spinescentia, bi-rarius tri-furcata v. simplicia, ossea.

6. **P. furcatus**, Rxb., Kurz, loc. c., p. 102.

*Barrotia diodon*, Gaud., loc. c., t. 8, fig. 9-14, apparently belongs to this species, but *Barrotia monodon*, ejusd., loc. c., fig. 14-25, can with equal probability represent very young drupes of *P. furcatus*, or full grown ones of the two following species.

7. **P. labyrinthicus**, Kurz, loc. c., p. 103.

8. **P. nitidus**, Kurz, loc. c., p. 103.

\*\* *Stigmata brevissima*, a dorso oblique depressa, marginibus rotundatis v. crenulatis.

9. **P. graminifolius**, Kurz, loc. c. 104.

10. **P. Ceramicus**, Rumph., Kurz, loc. c. 104.

SECT. III. KEURA. Drupae in phalanges connatae, raro unā alterāve simplice intermixtae; stigmata sessilia, v. sub-sessilia, peltata, v. reniformia; filamenta connata; antherae aristatae; ovula solitaria, (Kurz loc. c., cum syn.; *Tuckeya*, Gaud.; *Vinsonia*, Gaud.; *Barrotia*,

Gaud., ex parte ; *Hombronia*, Gaud. ; *Eudouxia*, Gaud. ? ; *Dorystigma*, Gaud. ?)

11. **P. Leram**, Jones (non Kurz), *P. Leram*  $\beta$ . *macrocarpa*, Kurz loc. c. 106.

*Pandanus Leram*, as represented by Fontana in Asiatic Researches, is my var.  $\beta$ . *macrocarpa* of my supposed *P. Leram*. The same variety agrees apparently very well with *Eudouxia macrocarpa*, Gaud., loc. c., t. XVIII, and perhaps also with *E. ? Delessertii*, ejusd. loc. c. f. 7-8, notwithstanding an apparent slight difference between the stigmata. Both forms, *P. Leram*, Jones, and *P. Andamanensium*, as I now shall call the form, described by me erroneously as *P. Leram* of Jones, occur on the Andaman islands, but I only could obtain of the former very old fruits, an account of which the recognition of the real form of stigmata was very difficult. In the Bot. Gardens, Calcutta, drupes of true *P. Leram* (coming from a plant in the gardens, said to be introduced from the Nicobars) are preserved, but also in a state unfit for a correct decision. The young plant (the old one having been destroyed by the Cyclone in 1864,) would also differ from *P. Andamanensium*, by the form of the leaves which are almost cuspidato-acuminate, and not simply acuminate. This appears to be one more reason for retaining the two forms as distinct species, until a re-examination of more complete specimens may enable me to give a more satisfactory explanation of the point in question.

12. **P. Andamanensium**, Kurz. *P. Leram*, Kurz loc. c. 105, *excl. var. \beta*. (non Jones).

13. **P. dubius**, Spreng., Kurz loc. c. 127.

*Hombronia edulis*, Gaud., loc. c. t. XXII, of 17, is not likely distinct from *P. dubius*, and *Barroetia tetradon*, Gaud., loc. c., t. XIII, f. 1—8, has all the appearance of being only a young syncarpe of the same plant.

14. **P. Kaida**, Kurz. *P. Candelabrum* ? Kurz loc. c. 27, *excl. syn. omnibus, excepta citat Rheedia*.

15. **P. Candelabrum**, P. d. B., Fl. d'Oware I. 37, t. 21-22 ; Kth. Exum. III. 97, (non Kurz) from Western Africa.

I have little doubt that Gaudichaud's *Tuckeya Candelabrum* (loc. c. t. XXVI, f. 10—12) represents the true *P. Candelabrum*, and have, therefore, changed the specific name of the previous species which is restricted to Inda.

16. **P. verus**, *Rumph.*, *Kurz loc. c.* 125.

I believe that all the *Pandani veri* of Gaudichaud have to be regarded as identical with the present species, as *Pandanus Linnaei*, Gaud. loc. cit. t. XXII, f. 1—8; *P. Chamissonis*, ejusd. loc. cit., f. 9; *P. fragrans*, *Rumphii*, *Rheedei*, *Loureiri*, *Menziesii*, *Boryi* and *Douglasii*, figured loc. cit. plate XXII. The two latter look somewhat similar to forms of *P. Andamanensium*, but such elongate drupes are found also occasionally in Indian forms of *P. verus*.

17. **P. laevis**, *Rph.*, *Kurz. loc. cit.* 126.18. **P. utilis**, *Bory*, *Kurz. loc. cit.* 131.

Here, as in the case of the former, I cannot agree at all with the view taken by Mr. Gaudichaud, as regards the definition of species, and I have good reason to believe that all the following of his proposed species have to be considered as synonyms of *P. utilis*.

*Vinsonia utilis*, Gaud. loc. cit., t. XVII. f. 1—5 et t. XXIII, f. 1—6 et 9—18 (*germinatio*); *Vins. stephanocarpa*, ejusd. loc. c. t. XVII, f. 2—6 et 7-8; *Vins. purpurascens*, ejusd. loc. c. t. XVII, f. 6—9; *Vins. humilis*, ejusd. loc. c., f. 10-11; and *Vins. elegans*, ejusd. loc. c., f. 12-13, all figured on plate XVII.

The last three forms are Wallich's *P. lucidus*, and are included loc. cit. under my var. *β. lucida*.

The drupes of *Vinsonia palustris*, ejusd. loc. cit. t. XVII. f. 18—23 are undistinguishable from those divided forms of *P. utilis*, of which I have given a few characteristic representations in Dr. Seemann's Journal v. t. 64.

19. **P. lucidus**, (*Vinsonia? lucida*, Gaud., loc. c. f. 14-15.)

This species, although very near to *P. utilis*, var. *lucidus*, is apparently distinct, differing in the form of the stigmata. A very good representation of it, exists in the Library of the Bot. Gardens, Calcutta, under the name of "*Pandanus lucidus*," Wall., but it is not the species which is now cultivated under that name in the gardens.

20. **P. sylvestris**, (*Vinsonia sylvestris*, Gaud., loc. c. t. XVII, f. 16-17).21. **P. Pervilleanus**, (*Vinsonia Pervilleana*, Gaud., loc. c., t. XXXI, f. 1—7; probably including also *Vins. drupacea*, ejusd., l. c. f. 8—13).

Besides the above named apparently well-founded species, the following somewhat dubious forms belong also to the section *Keura*.

*Dorystigma Madagascariense*, Gaud., loc. cit., t. XXXI, f. 12—13, and *D. Mauritianum*, ejusd., loc. cit., t. XIII, f. 25—27,

SECT. IV. MICROSTIGMA. Drupae simplices; stigmata sessilia, semilunata, reniformia, hippocrepiformia v. bilobata; filamenta connata; antherae truncatae v. apiculatae; ovula solitaria. (*Foullioya*, Gaud.; *Lussea*, Gaud. ex parte; *Jeanneretia*, Gaud.; *Heterostigma*, Gaud. ?; *Bryantia*, Gaud. ?).

\* *Stigmata terminalia, bilobata, lobis integris v. bilobulatis; filamenta connata; antherae apiculatae.* (*Foullioya*, Gaud.)

22. **P. racemosus**. (*Foullioya racemosa*, Gaud., l. cit. t. XXVI, f. 1—9, et *Foullioya maritima*, ejusd., l. cit. f. 21—24).

\*\* *Stigmata terminalia, reniformia v. hippocrepiformia; filamenta racemose connata; antherae truncatae.* (*Jeanneretia*, Gaud.)

23. **P. humilis**, Rumph., Kurz loc. cit. 105. *Sussea microstigma*, Gaud. loc. cit., t. XXV, f. 8—10.

Gaudichaud's figure represents a polygamous plant, not yet recorded in the genus *Pandanus*. The form of the anthers agree pretty well with those derived from the male spadices.

23. **P. littoralis**, (*Jeanneretia littoralis*, Gaud., loc. c., t. XXV, f. 1—7).

*Sussea lagenæformis*, Gaud., loc. c., t. XXV, f. 11—14, and *Heterostigma Heudelotianum*, ejusd., loc. cit., f. 15—31, I have not as yet been able to discriminate.

24. **P. latifolius**, Rph., Kurz l. c. 105.

The position of *P. latifolius* must still remain undecided, but it is certainly a very distinct species. The leaves, when recently dried, are scented and used by the Malayan ladies in their toilette cases, like the spathes of *P. verus* and *P. laevis*.

25. **P. conoideus**, (Thouars ?), (*Sussea conoidea*, Gaud., loc. cit., t. XXIV).

This is a very distinct species.

\*\*\* *Stigmata lateralìa.* (*Bryantia*, Gaud.)

26. **P. butyrophorus**, (*Bryantia butyrophora*, Gaud., loc. cit. t. XX).

This species very much resembles *P. Ceramicus* in the form of the syncarpe and of the drupes. The syncarpe of *P. Ceramicus*, however, is drooping when ripe, and the stigmata are also differently formed.

SECT. V. SOULEYETIA, Gaudichaud. Drupae simplices; stigmata semilunata v. subhippocrepiformia, subsessilia; ovula 3 placentae basilari instructa.

27. **P. freycinetioides**, (*Souleyetia freycinetioides*, Gaud., loc. c., t. XXIX).

Gaudichaud includes *Souleyetia* in the FREYCINETIEAE, but I think the respective species is more correctly referred to *Pandanus*.

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*Notes on the Geology and Physical features of the Jaintia hills;—*  
by CAPTAIN H. H. GODWIN-AUSTEN, F. R. G. S., *Topographical Survey of India*.

[Received 16th December, 1868, read 3rd Feb. 1869.]

The western boundary of the district of the Jaintia hills, is the river Mangat, crossed on the direct road from Lailangkot to Jawai; the valley is deep and extremely picturesque; the hills rising from the narrow strip of rice land at the bottom in steep slopes of grass and wooded ravines and close under the crest into precipitous scarps. Among others the Nongjerong hill presents very conspicuous features. The geological formation is here of metamorphic rocks, a well stratified gneiss, and in the bed of the river the boulders are almost entirely of that rock, mixed with quartzitic sandstone, and a few boulders are of a dark green trap.

Ascending from the river to the top of the slopes of the left bank, and passing the village of Simunting on the right, a short distance, the first patches of a stratified rock are seen, a coarse gritty sandstone of light colour, forming the tops of the little eminences and never exceeding here perhaps 20 feet in thickness. They are lost sight of as soon as the descent into the Mantadu commences, where the metamorphic rocks, dipping at high angle and with a E. N. E. strike, are seen again: the sandstone series reappearing when the opposite ascent is crowned. A strong interbedded conglomerate is very noticeable here, always lying at the base of this formation.

Its chief peculiarity now consists in the beds of dark purple hue, in others so fine, white or chalky in appearance, that they might almost be mistaken for the latter rock. Broken up and mixed with water it is used largely as a whitewash for native huts. Sandstone now forms the mass of all the elevated points in Jawai, and is conspicuous near the dāk bungalow, resting horizontally on the highly tilted older rocks. On the hill mass of Chirmang, south of Jawai and the Mantadu, its thickness has greatly increased, bringing in above the conglomerate thinner and finer beds, and less sandy in composition. Here we find traces of the carbonaceous shales and in places a dark, hard, earthy coal, invariably thin-bedded and altogether very local in its distribution. To the east of Latuber the same features may be seen all the way to Satunga, the metamorphics appearing on the higher parts of the plateaux, where the sandstone only occurs in isolated thin patches.

But at Satunga, we are introduced to a new series altogether, *viz.* the limestone (*nummulitic*), of which an outlier forms a mass with low perpendicular and jagged sides to the right of the road, and on the very edge of the southern depression of the level of the country. To the south-west one or two wooded isolated knolls shew the limits of the northern extension of that rock. It rests in this locality on the sandstones also associated with coal beds; and there is no doubt that these last are of secondary age, the prototypes of rocks better developed under Cherra Poonjee and thinning out at Maobelarkar, on the road to Shillong. There is also an appearance of a break in the succession between these secondary strata and the nummulitics, pointing to a long lapse of time, and to very different conditions of the surface, before the deposition of the limestone began. Here we are I think also near the confines of the tertiary sea in which those rocks were formed, as shown by the thinning out northwards of the limestone beds.

Proceeding south to the low range of hills of which War Hill Station forms the highest point, the limestone has greatly increased in thickness, and is superimposed at the same time by beds of quite a different mineralogical character, being nodular, ferruginous and highly fossiliferous. Above this well marked horizon no limestone with *Nummulites* was seen; local unconformity of these last is noticeable, and

either due to a falling in of the limestone, or, as I am more inclined to think, to a prior denudation of the limestone surface. The fossils are minute with an occasional Gastropod of larger size. This ridge, on the north of which lies Nongkli, well known as one of the last strongholds of the Jaintias during the rebellion of 1861-62, is succeeded on the south by the main ridge and the watershed of the hills, the stream at Nongkli being a feeder of the Kopili. Crossing a low pass at the head of the last mentioned stream, the view that suddenly opens out, is almost Himalayan; below lies the deep valley of the Umsnat, backed on the east by the high mass of Marangksi, its precipitous cliffs shewing out grandly against the noble forest that covers all else. In this great section, everything above the Nummulitics is exposed, this last forming the bottom beds in the valley succeeded by the fossiliferous ferruginous strata, and again above by an enormous thickness of soft, thick-bedded sandstone of light ochre tint;—this higher mass is the universal rock of all the higher forest-clad hills running thence due east to Asalu. In the bed of the Umsnat, the limestone is almost horizontal, but lower down has a very slight dip southward. It also thickens in this direction very rapidly with interstratified beds of sandstone.

The whole mass preserves its horizontality, and there is nothing very noticeable over a large and broad band, save that with the deepening valley lower beds of the limestone are exposed, but in no spot did I see sandstone of secondary age, or one that could be mistaken for it. The Umsnat joins the Simleng, and the united streams become the Lubah, which forms a junction with the Barak near Molagul. The Simleng and Lubah form a deep valley with an east and west strike, and the mass of the upper nummulitic or tertiary sandstone rises precipitously on the south, forming a ridge parallel with it. Upon this line, the first bending over to the south commences. The best section for observing this peculiar formation is near Katom, where the Lubah turns south in a gorge, cutting diagonally right across the whole mountain mass. The solid limestone of great thickness, perhaps 1,000 feet, and the higher sandstones all have the same great incline, becoming afterwards perpendicular and being succeeded at this above mentioned point by a thin-bedded series of newer rocks, clays and sandstones, of various colours and hardness. The angles of dip vary slightly north and south

of the perpendicular, they shew a great crushing, perhaps folding of the beds.

As we leave the higher hills for the low eminences (Tilas) the sandstones become coarser, having scattered through them strings of small pebbles, as also large lumps of lignite. In one place the whole of the roots and part of the trunk of a large tree were seen in the perpendicular strata of the river bank. These last mentioned rocks evidently are of lower Sewalik age, and are capped unconformably further into the plains, by masses of irregularly bedded clays and conglomerates, which pass under the present alluvial surface.

Before closing my remarks on the geology of the Jaintia Hills, the nummulitic coal should be alluded to. This has long been known to exist at Lakadong, and was there, I believe, once worked. The same formation occurs at many points further east, particularly near Narpo, at no great distance from the Lubah river, navigable for small boats; its value has yet to be made known and perhaps established. There is no reason why beds of considerable extent should not, with proper search, be discovered. Its position, high in the nummulitic limestone, is precisely the same as that at Cherra Poonjee. This coal is no where met with east of the Lubah and Umsnat rivers.

The most striking feature of this part of the Khasia range of hills, is the extremely even height of the central mass. Nowhere is this so well seen as from the peaks of the north Cachar range Marangkshi, &c., the dead level line of the whole mass as far east as Timang Hill Station, is from here most noticeable; even the Shillong peaks make hardly any shew in the distance. This central mass or high table land is all of gneiss associated with granite, generally at a high angle with a W. S. W. to E. N. E. strike, and the denudation it has been subjected to must have been enormous prior to the secondary epoch. It falls very gradually to the south for a long distance, with a last sudden dip over Jaintiapur. On the north the lower levels are successively reached by a series of steps, that can be followed for many miles, the last descent being the greatest, corresponding to the like sudden depression at Nunklow, &c. Timang and Saranthu mark the limit of this table-land on the east, and overlook the far lower country of the valley of the Kopili. In the Jaintia district

the trap rock comes in with the fall in the country, and the high isolated peaks to the south of the Mangkhen are found to be a continuation of the quartzitic sandstones of the Shillong peak, &c., almost perpendicular, but lying up against an amygdaloid trap, associated with a true granite which comes in with an east and west run on the north, and forms the remarkable rounded bosses, such as Billu Kongor, &c. Granite also occurs contiguous to the gneiss north of Nartiang, and thence in an easterly direction immediately north of Nongjinghi which is almost the highest point of the Jaintia hills, 4,563 feet above sea level. The Nongjinghi ridge is gneiss, resting against the granite. As at Lailangkote in the Khasia hills, the trap is closely associated with the granite, and in such situations the titaniferous iron sand is found in great quantity, and smelting furnaces are seen in all the adjacent villages. This dark green trap appears to have been injected between the granite and gneiss, or between the former and the quartzitic sandstones at or about the period of the great disturbance and change in the metamorphic series. The parallelism of the drainage lines south-east of Jawai, is very remarkable, and with the cross-drainage at right angles breaks the country up into irregular parallelograms, which probably display a monster jointing of these metamorphic rocks.

The most remarkable lines taken up in succession by different great valleys and ravines are—1st, a main line, rather irregular, but to which all lines to the south conform, commencing on the west at Karpentèr village on the Mangat; that river carries it to Jarain, E. N. E., up to the junction of the Kawa Manvi with the Mantadu, north-westerly by the Keremontha ravine past Wapùng into the Umpa-ai and by the Mùrin into the Kopili near Thelgasi; this last river continuing on for many miles with a north-east course, altogether constituting a great physical feature extending from west to east for 55 miles. The 2nd line, at an average distance on the south of 6 miles, can be traced from Pomtadong, past Thangbuli, to the Mantadu river at the junction of the Baliang, on the left bank, following this last named river, over the watershed into the Lonnang river, and in succession by the Umkorpong to the north of Satunga, where this river turns sharp at right angles to the south. Yet the same direction can be carried on to Umthnong, and is lost in the sudden W. S. W. bend of the Kopili.

The third line can be taken up at the base of the hills near Jaintiapur, by the river Rangpàni, into the Umchaliang, S. W. to N. E., crossing the Mantadu, on again to the Làma river, past Thampianai G. T. S., into the Pamesken, and by a succession of ravines to the north-west of Khleriat, where the last stream, the Shashem, turns to the S. S. E. The same run, but with a more east and west course, is taken up in succession on the north by the Muntang and Munriang rivers, tributaries of the Kopili, and lastly by the Mankhen.

These great lines of continuous depression are again displayed further on the south and east and shew there a decided curvature. I may note the Lubah, Simleng and Artan into the head waters of the Kopili, north of Sherfaisip, and again further south the deep depression marked by the valleys of the Kùmra Làrang, Kayeng into the Jatinga and, taken upon the north of the main watershed at Asalu, by the valley of the Dhansiri. To the south of this the strata are found tilted high in that direction giving the more pointed shape to the peaks of the south-west Burail range. The line is intimately connected with the original elevation of the whole mountain mass, and the parallel continuous lines, already noticed, are doubtless due to the same parallel forces of elevation. As might be expected the geological formations all coincide with these great natural flexures, carrying the nummulitic series with its limestones, and the cretaceous rocks, far north on the Kopili, and thus into the valley of Assam.

*Camp, North Cachar, December, 1868.*

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*Descriptions of marine Gastropoda from Ceylon, &c. ;—*  
by MESSRS. G. AND H. NEVILL.

[Received and read 3rd February, 1869.]

This paper is a continuation of the one we had the honour of placing before the Society at the August meeting of last year (1868). These new species, as likewise those previously described, were, with one exception, collected in the Southern Province of Ceylon, mostly near Balapiti; the *Rapana*, one of us had previously also found at La Réunion (Bourbon). We have also seen several of the small species of TROCHIDÆ from Bombay and Arakan, probably all of them are to be met with along our coasts, though the small and interesting little species, we have here named *Euchelus Seychellarum*, we have never met with anywhere in these seas, except at the Island of Mahé, one of the Seychelle group.

**Clanculus Ceylonicus**—N. S., Pl. XVII, Fig. 7.

*T. parva, turbinata; anfractibus senis, convexiusculis, albescentibus, prope suturam posteriorem maculis fuscis transversaliter prolongatis notatis, ad suturam anteriorem puncturatis; costulis spiralibus quinis in quoque anfractu granulosis; sutura subprofunda; ultimo anfractu ad peripheriam subrotundato; basi leviter convexiuscula, granulato-costulata, umbilicata: umbilico margine incrassato ac denticulato circumscripto; apertura quadrangulari, labro intus crasse costulato, labio calloso, recto, ad medium obsolete, antice crasse dentato.*

*Alt. 7 Mil.—Diam. maj. 7 Mil.*

Abundant.—S. Prov. Ceylon;—also occurs at Bombay.

**Euchelus Seychellarum**—N. S., Pl. XVII, Fig. 10.

*T. parva, depresso-conica, sub-globulosa, alba, solidula; anfractibus quaternis, convexiusculis, suturâ impressâ junctis, costulis spiralibus minute sed confertim granulatis ornatis; ultimo anfractu ad peripheriam rotundato; basi convexâ, spiraliter granulato-costulata, anguste umbilicata; apertura subrotundata: labro uniforme arcuato, ad marginem obtusiusculo, intus sulcato; labio recto, oblique decurrente, antice denticulo parvo instructo.*

*Alt. 2½ Mil.—Diam. maj. 3 Mil.*

Scarce.—Island of Mahé (one of the Seychelle group).

**Gibbula Dupontiana**—N. S., Pl. XVII, Fig. 8.

*T. parva, trochiformis, pallida, transversaliter maculis irregularibus fuscis notata; anfractibus costulis senis spiralibus, crassis circumdatis, prope suturam angustioribus, transversaliter lineis subtilissimis obliquis ornatis; ultimo anfractu ad peripheriam angulato, ad basin applanato, profunde umbilicato; apertura sub-quadrangulari, labro ad marginem acuto, intus sub-incrassato; labio tenui, simplici, leviter arcuato.*

*Alt. 7 Mil.—Diam. maj. 6 Mil.*

Common on sea-weed at low water, S. Prov. Ceylon.

This species is named after M. Dupont, of Mauritius, whose indefatigable zeal has so greatly increased our knowledge of the interesting fauna of that Island. The nearest shell, I know of, to the above is one described by Reeve as *Ziziphinus vexillum* (G. Nevill).

**Gibbula Blanfordiana**—N. S., Pl. XVII, Fig. 9.

*T. parva, turbinata, depresso-globulosa, solida, alba, rubide variegata et marmorata; spira ad apicem sub-obtusa; anfractibus quinis, postice sensim angustioribus, ad medium sub-angulatis, spiraliter costulatis: costulis senis, crassiusculis tenuioribus alternantibus; ultimo anfractu ad peripheriam rotundato; basi convexiuscula, umbilicata: umbilico callositate albida, paulo incrassata, circumscripto; apertura sub-rotundata, labro crassiusculo, intus striato, ad marginem eleganter crenulato, postice paulo deflexo; labio prope recto, oblique decurrente, levi, ad medium paululum incrassato.*

*Alt. 5½ Mil.—Diam. maj. 6½ Mil.*

Not uncommon;—S. Prov. Ceylon; found on sea-weed at low water.

A somewhat allied species to the above was described by Deshayes in his work on the shells of Bourbon, as *Turbo (!) filifer*, the differences in the umbilicus, the columellar margin, &c., however, distinguish it at the first glance. I have also seen this species from Arakan, in Mr. H. F. Blanford's fine collection; like the following, it probably has some considerable range in these seas. (G. Nevill).

**Gibbula Stoliczkana**—N. S., Pl. XVII, Figs. 2-3.

*T. conoidea, parva, solidula, olivacea seu rufescens, maculis transversalibus pallidis notata, aut minute variegata, epidermide fulvescente induta; anfractibus senis, sub-planis, suturá impressá sejunctis, spira-*

*liter minute sulcatis : sulcis liris depressis latioribus, æqui-distantibus separatis ; ultimo anfractu maximo, ad peripheriam angulato ; basi leviter convexa, spiraliter striata, profunde et anguste umbilicata, in excavatione umbilici albida ; apertura oblique quadrangulari, intus callositate moderata ac lævi instructa ; labro ad marginem sub-obtusos, labio prope recto, albido, antice truncatim desinente.*

*Alt.*  $6\frac{1}{2}$  *Mil.*—*Diam. maj.* 5 *Mil.*

Not uncommon, in the same places as the preceding.

This pretty little species varies immensely, not only in colour and size, but also as regards the convexity of the whorls and the angle of the spire. There are specimens from Arakan and from the Andamans, in the collection of Dr. Stoliczka, after whom the species is named, and who kindly assisted us in drawing up the descriptions of the species noticed in this paper.

### **Gibbula ? sub-plicata**—N. S., Pl. XVII, Fig. 1.

*T. turbinata, tenuis, semipellucida, alba ; anfractibus quinis, tubulosis, ad suturam applanatis, spiraliter costulatis : costulis in anfractu penultimo tribus, omnibus valde prominentibus, interstiis profundis, distantioribus separatis, in anfractibus superioribus transversaliter cancellatis seu scrobiculatis, in ultimo spiraliter subtilissime striatis ; anfractibus omninis ad suturam transversaliter plicatis ; basi subconvexa, anguste umbilicata, quatuor costulis spiralibus ornata, interstiis duobus, prope umbilicum sitis, transversaliter costulatis ; apertura fere circulari, margine simplici circumdata, labio moderate insinuato ; superficie interna paululum margaritacea.*

*Alt.* 5 *Mil.*—*Diam. maj.* 4 *Mil.*

Rare ;—S. Prov. Ceylon.

There is some difficulty in determining in what genus, or sub-genus to place this curious little species, the thinness of shell and the peculiar sculpture of the body-whorl, as well as the slightness of the internal pearly layer, make its position, as long as the animal and operculum are unknown, somewhat doubtful.

### **Tallorbis**—N. Sub-G.

*T. sub-orbiculata, subconica, columellâ solidâ, antice applanatâ, transversaliter plicata et abrupte termiata instructa ; habitu generi, Thalotia dicto, affinis.*

We experience some considerable difficulty in determining the exact

position of the above sub-genus. *Thalotia* appears to be the one to which it is next allied, though the general form, sculpture and substance are very far removed from any species of that genus with which we are acquainted.

**Tallorbis roseola**—N. S., Pl., XVII, Fig. 5.

*T. depresso-conica* ; anfractibus quinis, in latitudine rapide crescentibus, suturis profundis sejunctis, spiraliter distanter costulatis : costulis in anfractu penultimo tribus ; omninis distantibus, tuberculis numerosis, roseis eleganter ornatis, interstiis latis, una stria spirali in medio divisis, transversaliter cancellatis ; basi convexa, similariter ornata ; apertura ampla, subrotundata, margaritacea, intus in adultis speciminibus lævi, in junioribus sulcata : labro haud incrassato, ad marginem crenulato, labio tenui ; columella antice incrassata, subreflexa, plicis tribus, tortis instructa.

Alt.  $11\frac{1}{2}$  Mil.—Diam. maj. 11 Mil.

Very rare ;—S. Prov. Ceylon.

**Pisulina**—N. G.

*T. crassiuscula*, polita, semi-globosa, neritiformis, spirâ brevi, apertura sub-orbiculari, integrâ, haud umbilicatâ instructa ; labio columellari applanato, calloso, in medio dentiforme dilatato, labro simplici.

This genus approximates so closely to *Calceolina* of A. Adams, that we entertained doubts, as to whether it was desirable to separate it, the remarkable protuberance of the inner columellar lip, however, decided us on doing so, though, until the animals and opercula (if any?) have been carefully examined, we shall feel some doubts, as to whether both of them are not mere sections of *Teinostoma*.

**Pisulina Adamsiana**—N. S., Pl. XVII, Fig. 4.

*T. parva*, alba, lævis, solida ; spira obtusa ; anfractibus quaternis, superis interne, sicut in speciminibus *Neritarum*, evanidis ; sutura indistincta ; labio columellari calloso, polito, lævi, denticulo lato, depresso ad medium munito ; labro intus paululum incrassato, polito, ad marginem acuto.

Alt.  $4\frac{1}{2}$  Mil.—Diam. maj. 4 Mil.

Dead, on the sands ; S. Prov. Ceylon.

We have named the above interesting little species after Mr. Henry Adams, who has most kindly given us much valuable assistance and aid, besides describing many of our new Mascarene shells.

**Rapana bella**—N. S., Pl. XVII, Fig. 6.

*T. pyriformis, tenuis ; anfractibus quinis, convexis, suturâ impressâ junctis, ultimo anfractu valde inflato ; spira brevi, obtusiuscula ; superficie alba, fasciis ac striis roseolis, transversaliter elongatis notata, ac striis spiralibus, postice sub-obsoletis, antice ad basin crassis, lamellatis, seu crispiculatis ornata ; apertura lata, arcuata, postice sub-angulata antice multo angustiori ; labro simplici, tenui ad marginem undulato ; labio levi. imprimis antice calloso ; basi producta, antice canali brevi recurvato, terminata, umbilicata : umbilico carinâ rugatâ seu lamellosâ circumscripto,*

*Alt. 21 Mil.—Diam. maj. 22 Mil.*

Very rare. Bourbon and Ceylon.

Wood in his "Catalogue of Shells" (pl. 18, fig. 31b) figures a shell apparently belonging, to this species, under the name of *Bulla rapa*, Lin., from China. Hanley, however, in his "Ipsa Linnei Conchylia" states that Linnaeus' *Bulla rapa* is identical with Lamarck's *Pyrrha papyracea*, a quite different species from the present one.

**Emarginula papilionacea**—N. S., Pl. XVII, Fig. 12.

*T. ovato elongata, subconica, moderate elevata, tenuis, alba ; apice sub-centrali postico, acuminato ac incurvo ; superficie, costulis radiantibus quindecimis fortioribus, sub-tuberculatis ac scrobiculatis, lineis alteris numerosis tenuioribus, rugulatis interpositis ornata ; fissura antica moderate incisa, subangusta, postice elevata ac rugulosa ; superficie interiori nitida, radiatim leviter sulcata, impressione musculari quadripartita, partibus duabus anterioribus multo minoribus quam posteribus, omnibus triangularibus convergentibus.*

*Long. 12½ Mil.—Diam. 9 Mil.*

Very rare,—S. Prov. Ceylon.

There is no species at all resembling this handsome shell ; the internal impression bears a rather striking resemblance to a butterfly, the shell is sufficiently transparent for it to be clearly discernible from the exterior.

**Emarginula capuloidea**—N. S., Pl. XVII, Fig. 16.

*T. parva ; regulariter ovata, capuloidea, tenuis, pellucida, apice postico, arcuatim incurvato, instructa ; superficie costulis per-numerosis acutis, æquidistantibus, tenuioribus alternantibus notata, interspatiis*

*profunde ac rude scrobiculatis ; aperturæ marginibus valde crenulatis ; fissurâ centrali, antica, anguste et moderate incisâ ; impressione palliali postice rotundata, prope apicem lateraliter profunde insinuata, antice prolongata ac gradatim latiori, ad terminationem truncata.*

*Long. 5½ Mil.—Diam. 4 Mil.—Alt. 3 Mil.*

Very rare,—S. Prov. Ceylon.

The nearest allied species to the above, that we know of, is *E. crassicostata*, Sow., it is, however, smaller, more elevated, not narrowed anteriorly and the sculpture is somewhat different.

**Sub-emarginula Oldhamiana**—N. S., Pl. XVII, Fig. 17.

*T. oblonga, conico-elevata, solida ; apice acuto, sub-centrali, sinistorse incurvato ; superficie externa virescenti, in parte anteriori 5-6—costata : costâ mediâ maxima, ad marginem aperturæ valde prominenti, intus profunde canaliculata, in parte posteriori costis senis radiantibus instructa ; omninis plus minusve rugatis, atque costulis et striis numerosis interpositis, versus apicem obsoletis notata ; superficie interna albida ; impressione palliali magna, prope marginem anteriorem profunde insinuata.*

*Long. 12 Mil.—Diam. 7½ Mil.—Alt. 9 Mil.*

S. Prov. Ceylon, Scarce.

The shell approaching nearest to the present species is *S. Panhiensis*, Q. and G., from which it differs by the peculiar sinistral bend of the apex, which is likewise more decidedly central by the greater production of the anterior rib, forming a far more prominent canal, by the great inequality of the radiating ribs, &c.

**Solarium impressum**—N. S., Pl. XVII, Fig. 11.

*T. late-conica, depressiuscula, solidula, rufulâ seu radiatim fusco strigatâ ; anfractibus quinis, depressis, suturâ profunda junctis, spiraliter quatuor seu quinque striis minute granulosus notata, striis incrementi obliquis sub-distincte decussatis ; suturis impressis earumque marginibus paulo incrassatis ac granulatis ; ultimo anfractu ad peripheriam sub-carinato, ad basin convexo, profunde umbilicato ; umbilici margine incrassato granulatoque ; granulis albidis, mediocriter prominentibus ; apertura oblique quadrangulâri marginibus simplicibus instructa.*

*Alt. 3 Mil.—Diam. 5½ Mil.*

S. Prov. Ceylon.

Though possessed of no very distinctive characteristics, there is no species, I know of, with which the preceding can be confounded.

**Fissurella (?) Scrobiculata**—N. S., Pl. XVII, Fig. 15.

*T. parva, depressa, fere regulariter ovalis, lateraliter prope medium paululum angustata, antice ac postice rotundata, alba, fasciis radiantibus haud distinctis fulvescentibus notata; superficie omnina supra minute scrobiculata, ac striis radiantibus subobsoletis ornata; foramine late ovato, sub-postico, margine elevato circumdato; margine aperturæ attenuato, minute crenulato; superficie interna alba.*

*Long.*  $9\frac{1}{2}$  Mil.—*Diam.*  $5\frac{3}{4}$  Mil.—*Alt.*  $2\frac{1}{2}$  Mil.

Scarce, S. Prov. Ceylon.

The sculpture of this interesting shell is very peculiar, the surface being covered with rough, diamond-shaped scrobiculations, perhaps caused by its being covered by the mantle of the animal, in which case, this species will have to be removed to *Macrochisma*.

**Fissurella canalifera**—N. S., Pl. XVII, Fig. 13.

*T. ovato-elongata, antice angustata et ad terminationem retrorse elevata, solidula, concentrice lamellose rugata et striis inæqualibus radiantibus ornata, rufescente pallida, nonnullis maculis elongatis obscuris radiantibus notata; foramine longo, sub-centrali, antice ac postice rotundato; superficie interna albida; margine aperturæ obtusiusculo, fere simplici, minute crenulato, antice insinuato; margine foraminis paulo incrassato, obtusiusculo.*

*Long.* 14 Mil.—*Diam.*  $7\frac{1}{2}$  Mil.—*Alt.*  $4\frac{1}{4}$  Mil.

S. Prov. Ceylon.

Easily distinguished from any other species of *Fissurella*, by the curious way in which the shell, at the anterior end is turned up and contracted, thus forming interiorly a sort of canal; the black stripes in position, also, seem tolerably constant, there being two broad ones radiating from the posterior end of the foramen and the same number, but narrower and more indistinct, from the anterior end.

**Macrochisma scutiformis**—N. S., Pl. XVII, Fig. 14.

*T. ovato-elongata, lateraliter compressiuscula et paulo insinuata, moderate elevata, solidula, striis radiantibus ac concentricis minutis ornata, sordide albida, fasciis nonnullis radiantibus fuscis notata; foramine longo, excentrico fere tertiam partem diametri longitudinalis occupanti, postice angustato; margine aperturæ obtusiusculo, simplici; margine foraminis intus incrassato.*

Long.  $12\frac{3}{4}$  Mil.— $6\frac{1}{2}$  Mil.—Alt. 2 Mil.

Rare,—S. Prov. Ceylon.

We know of no other species of the genus with a similarly formed foramen; it differs from *M. hiantula*, Swains., not only in the above respect, but also in colour and in being laterally more compressed.

**Rocellaria cordiformis**—N. S., Pl. XVII, Fig. 18.

*T. parva, fragilis, longitudinaliter oblonga, albida, antice obtuse acuminata, postice producta, sub-rotundata; umbonibus tumescentibus, paulo prominentibus, incurvatis; hiatus cordiformi, parvo, vix dimidiam partem testæ occupante; superficie striis subtilibus, antice fortioribus, undique acutis ac confertis ornata, et sulca lævi ab umbone utriusque valvulæ oblique ad marginem ventralem medianum decurrente notata.*

Long.  $6\frac{1}{2}$  Mil.—Diam.  $3\frac{1}{2}$  Mil.

S. Prov. Ceylon. In coral.

The smallness of size and the peculiar heart-shaped form of the hiatus, easily distinguish this species from others.

*Ornithological Notes, chiefly on some birds of Central, Western and Southern India; by WILLIAM T. BLANFORD, F.G.S., C.M.Z.S., &c.*

[Read and received 3rd March, 1869.]

The following are a few notes on collections of birds made 1st, in Nág-púr, Chanda, and on the upper Godávery; 2nd, at and near Khandalla on the Western Ghats near Bombay; 3rd, on the Nilgiri hills in Southern India. The first alone was large, and was made during the cold and hot seasons of 1866-67; the other two during short visits to the places named. By far the greater portion of the ensuing pages refer to the first collection alone. Several of the birds observed and collected are very rare: one, *Salpornis spilonotus*, Franklin, had only been previously procured by the describer and by Mr. Hodgson, and no specimen of the bird was ever seen by Mr. Blyth or by Dr. Jerdon, until very recently. *Hirundo fluvicola* had not, so far as I am aware, ever been found again in Central India, since Dr. Jerdon first described it, and *Cyornis Tickellæ*, Blyth, has equally escaped observation since first collected by the excellent ornithologist after whose wife it was named, while the range of several species noted below, was not previously known to extend into the countries mentioned.

I have, in every case, given the number of the species in Jerdon's work, but I have preferred following a somewhat different classification. Although deficient in some respects, as for instance in associating *Saxicola* and *Muscicapa* in one instance, and *Phylloscopus* and *Tyrannus* in another in the same sub-family. Mr. Blyth's classification in the catalogue of the birds, belonging to the Museum of the Asiatic Society of Bengal, published as long ago as 1849, is, in many respects, more in accordance with our present knowledge of the affinities of birds, than that adopted in Gray's and Horsfield's catalogues. The classification, I have followed is, in the main, identical with that of Prof. A. Newton, as employed in the Zoological Record, but I have followed Jerdon in classing together the bulbuls and orioles, and have followed neither Jerdon nor Newton with regard to the *Sylviidæ*.

In the present notes, I have not attempted to mention all the birds met with. I have merely noticed those concerning which I have observed some interesting particulars connected with their distribution, habits, nidification, &c. The natural history of the common Indian species is pretty well known, though there is still something to be learned very often concerning the range of allied forms, as for instance amongst the *Motacillæ*.

I believe the most interesting part of my observations is, that which relates to the relative distribution of some of the migratory birds. It has been for some time known that Eastern and Western forms of these meet in India in several cases, and in the following pages some additional instances will be found.

## Order RAPTORES.

### Tribe DIURNÆ.

#### Family VULTURIDÆ.

##### Sub-family *Neophroninæ*.

6. **Neophron ginginianus**, Daud. (*N. percnopterus*, L. apud Jerdon). Jerdon does not mention the breeding season, which varies much. I found a nest with two young ones considerably grown and probably a month old on April 14th. The nest was on a cliff at the side of the river Warda. Later than this, on May 2nd, I found another nest containing a single egg, well incubated with a fully formed chick inside. This was on a tree.

The relative ranges of *Neophron percnopterus* and *N. ginginianus* require to be ascertained. Specimens from Western India should be carefully examined.

Family FALCONIDÆ.

Sub-family *Falconinæ*.

18 ? **Tinnunculus Cenchris** ? Naum. I shot a female Kestrel on the Pem Gunga river, west of Chanda, differing from the common species in size, being smaller than the male of *T. alaudarius*, and having dull yellow legs instead of the usual pale clear yellow. The wing measures 9.75, tail 6.5, tarsus 1.7 inches. The tail is much more richly barred than in *T. alaudarius*, and the bars extend completely across the feathers. The back is much browner and less rufous. I am inclined to think this possibly a young *T. cenchris*, a bird never before recorded from Central India. It differs, however, in having much coarser legs, as coarse as in *T. alaudarius*, and in the colour being much duller and browner than in the specimens in the Indian Museum.

Sub-family *Aquilinæ*.

29. **Aquila fulvescens**, Gray. The most abundant eagle in the Nágpur and Chanda country. I have lately obtained several specimens of the nearly allied *A. nævioides*, Cuv., from Abyssinia, which fully bear out the distinctions pointed out by Mr. Blyth and Dr. Jerdon. The bill and legs are constantly larger in the African species. The plumage is very similar.

The only other Eagles of which I obtained specimens in the neighbourhood of Chanda were *Spilornis cheela* and *Pandion haliaëtus*.

Sub-family *Buteoninæ* (?)

50. **Circus cyaneus**, L. I obtained a fine female and a young male of this species near Chanda, on the 1st and 13th of March respectively. I do not think there can be any reasonable doubt of the identification, as I noted that the birds agreed with the description of *C. cyaneus* at the time, and I subsequently compared them with European specimens in the Museum at Calcutta. This is the first instance, I believe in which the occurrence of this bird so far south as the Central Provinces has been noticed, specimens, if seen, having not probably been distinguished from *C. cineraceus*. I see,

however, that Dr. King has obtained it from Goona,—J. A. S. B., 1868, Part II, p. 213. Dr. Jerdon was not aware of its occurrence south of the Punjab.

53. **Circus melanoleucos**, Gmel. I certainly did not once see this bird in the Central Provinces, and I never remember having met with it in Western India. It has been found by Radde breeding on the Amoor, and may very possibly be one of those Eastern Asiatic species, the range of which only extends partly across Hindustan, like *Motacilla luzoniensis*. It is not included in Sykes's Deccan list.

Sub-family *Milvinæ*:

**Milvus sp.** I shot near Woon, North West of Chanda, a kite considerably exceeding the common *M. Govinda* in size, but otherwise undistinguishable. It is a male, and measures—closed wing 20 inches, bill from the gape 1.7, tarsus 2.5, tail 13. The bird is evidently young, but the inner portions of the feathers are rich brown; for the feathers of the head and neck are rich brown with dark centres, not whitish as usually in a young *Milvus Govinda*, and the abdomen and lower tail coverts are pale rufous.

I obtained also near Chanda *Pernis cristata* and *Elanus melanopterus*, both assigned to the subfamily of the kites by Dr. Jerdon, though their position is somewhat doubtful. Blyth makes each the type of a distinct subfamily.

#### Tribe NOCTURNÆ.

##### Family STRIGIDÆ.

65. **Syrnium ocellatum**, Less. (*S. sinense*, Lath., apud Jerdon). This bird appears not to be rare south of Nágpur, inhabiting mangoe topes. I see also that Dr. King mentions it in his Goona list. Owls, and indeed all the larger raptores, require to be watched for, and they are not generally obtained by any one passing through a district and unacquainted with their local haunts, so easily as the *Insessores*. The only other owls I obtained in the Central Provinces were the common species *Urrua Bengalensis*, *Ketupa Ceylonensis* and *Athene Brama*.

#### Order ALTRICES.

##### Family PSITTACIDÆ.

148. **Palæornis torquatus**, Bodd. I have lately shot the

African race (*P. cubicularis*, Hasselquist) in Northern Abyssinia. The only distinction I can detect from the common Indian *P. torquatus* is, that the former bird has a larger bill.

I thought, I saw *P. Alexandri* once or twice in the great forests south east of Chanda, but I am not sure. It is certainly rare in Central India.

## Order INSESSORES.

### Suborder PICÆ.

#### Family PICIDÆ.

160. **Picus Mahrattensis**, Latham. Chanda jungles, local. The closely allied race which Mr. Blyth did me the honor to name after me, was found, not abundantly, at Thayet Myo, and again above Ava. It probably is peculiar to the dry country of upper Burma.

164. **P. (Yungipicus) Hardwickii**, Jerdon; not rare in the Chanda jungles. It usually occurs in small companies of 3 or 4, hunting about the upper branches of trees. My specimens were rather smaller than the dimensions given by Dr. Jerdon.

166. **Chrysocolaptes festivus**, Bodd. I shot one specimen near Chanda, the wing measures only 6 inches.

The only other woodpecker killed in the Central provinces was the very common *Brachypternus aurantius*.

#### Family CUCULIDÆ.

199. **Cuculus canorus**, L. I killed a male on the 24th April on the Pranhita river north of Sironcha. On the 4th May, near Sironcha, I shot another, and heard others calling then and on subsequent days. I did not observe any females, but I had no time to look for them.

212. **Conystes melanoleucos**, Gmel., shot at Khandalla on the western ghats near Bombay. I obtained a bird in Abyssinia which I cannot distinguish from this species.

222. **Tacconia affinis**, Blyth. Two or three specimens from the neighbourhood of Nágpur agree best with this race in dimensions, but one of them has rather the colouring of *T. Leschenaultii*, Lesson. I much doubt if these races should be distinguished. *T. Sirkee*, Gray, appears rather more distinct.

## Family CAPRIMULGIDÆ.

The only species met with in the Nágpúr country were *C. asiaticus* and *C. monticolus*. In the great forests about Sironcha, in the beginning of May, the noise made towards morning, just before day-break, by the nightjars, was incessant. The cry is most singular, and is well described by Jerdon as resembling that made by a stone bounding over ice and gradually striking at shorter intervals than at first. I am not quite certain which species it was which made the noise, but I suspect *C. monticolus*, which appears to be more common in those forests than any other species.

## Family CYPSELIDÆ.

100. **Cypselus Abyssinicus**, Ehr., of which I obtained several specimens in Abyssinia, is unquestionably identical with the Indian species, and Ehrenberg's name is said by Tristram to have priority. Blyth, Ibis, II. 339, places *C. abyssinicus*, Streubel, as a synonym of *C. affinis*, but I am inclined to believe Mr. Tristram is right.

104. **Dendrochelidon coronata**, Tickell. This fine swift is far from rare about Chanda, and I can fully confirm Jerdon's excellent account of its habits. Though it has a rapid flight, it is not by any means equal in this respect to the Alpine swift, much less to the *Acanthyliis* group; I almost doubt if it equals *Cypselus apus*. Indeed it always appeared to me to afford an easy shot for a swift.

95. **Acanthyliis sylvatica**, Tickell. Although I was on the look out for this rare swift, I never had the good fortune to secure a specimen, and I doubt if its range extends to Nágpúr or Chanda. I once saw a small swift flying past a hill near Ahiri on the Pranhita which may have been this species, but it did not come within shot.

In the Ibis for 1866, Vol. II. p. 78—Mr. Tristram seems to doubt Dr. Jerdon's assertion that the flight of *Cypselus melba*, though elegant and rapid, is not nearly so powerful as that of the two spine-tailed species. "If so," says Mr. Tristram "the speed of the latter must be a considerable improvement on the greased lightning of American imagination." On the latter point I cannot pronounce an opinion, as I never saw any greased lightning, but it is equally certain that Mr. Tristram never saw the flight of *Acanthyliis*. It is some

years now since I made their acquaintance in Pegu. I cannot say to which species the birds belonged, for I could never get a gun to my shoulder before they were out of shot, but the impression remaining upon my mind is, that their speed exceeded that of *C. melba*, which I shot in 1867 at Coimbatore, just as the Alpine swift excels the common swallow.

#### Suborder PASSERES.

##### Family PITTIDÆ.

345. **Pitta Bengalensis.** In the forests around Chanda and on the Pranhita, I did not once see this species; near Sironcha I seemed to come suddenly into its range, and found it abundant there and on the Godavery. One specimen which I shot had been feeding partly on the common large black ant of the Indian jungles, but the principal food appeared to have been termites with a few *coleoptera*.

##### Family MELLIPHAGIDÆ.

631. **Zosterops palpebrosus**, Temm. Rare in the Central Provinces. I only came across 3 or 4 specimens. The Nilgiri race is a little larger and appears to be a little darker in colour. I have only one specimen to compare, in that the beak is 0.4 in., wing 2.2, tail 1.75, tarsus 0.7 in. In a specimen from Manbhúm, the beak is 0.35, wing 2.15, tail 1.55, tarsus 0.6. The bill appears a little variable. The black lores appear rather more developed in the Nilgiri bird. I doubt whether it is wise to propose a distinctive name upon such slight differences, as intermediate forms may be found.

##### Family NECTARINIDÆ.

234. **Arachnechthra Asiatica**, Lath. I can quite confirm Jerdon's account of the female of this bird retaining her dull colours in the breeding season.

##### Family CERTHIIDÆ.

246. **Salpornis spilonota**, Franklin. Ibis, 1867, p. 461, and Gould's birds of Asia, Part XX.

This very rare bird appears also to have been noticed lately by other observers and ranges as far as Oude. My specimens were obtained in the great forests on the Pranhita south of Chanda, where I used to see the bird nearly every day.

The following is a complete description taken from a comparison of freshly killed specimens.

Colour above brownish black, spotted with white, feathers of the crown with a more or less narrow central white stripe, supercilium white and beneath it a dark stripe passing through each eye to the nape. The sides of the neck chiefly white, with slight dusky marks, while the back of the neck has only very few and small white spots. Two central tail feathers dull grey brown in the centre, edged with alternating dusky and white spots, the former larger; outer tail feathers dusky, each with 4 more or less interrupted white bands and tipped with white. Throat white, occasionally with a few dusky marks, remainder of lower plumage mixed white and dusky, darker on the sides and lighter on the breast. Beak blackish above, flesh-coloured below, legs dark horny inclining to plumbeous, irides brown. Sexes alike. Measurements, taken before skinning;—Length  $5\frac{1}{4}$  to  $5\frac{3}{4}$ , extent  $9\frac{1}{2}$ , closed wing  $3\frac{1}{4}$  to  $3\frac{1}{2}$ , tail  $2\frac{1}{8}$ , beak at front  $\frac{3}{4}$  to 1, tarsus  $\frac{5}{8}$ , foot  $1\frac{5}{8}$ . The bill in the male is shorter than in the female, in the former it is generally  $\frac{3}{4}$  inch, in the latter  $\frac{7}{8}$  to 1 inch.

The birds keep to the largest trees, running round the stems in all directions, and flying with a steady flight, not unlike that of a woodpecker, but swifter and more elegant. They have a whistling note. They evidently breed about the end of April, as birds killed at that time had the generative organs greatly enlarged, and I constantly saw them in pairs. On one occasion I came upon two pairs together. I found *Coleoptera* in the stomachs of those I examined.

#### Family HIRUNDINIDÆ.

84. **Hirundo ruficeps**, Licht. (*H. filifera* Stephens apud Jerdon). In November, December and January these birds are in small flocks generally, not exceeding 15 to 20, and have a particular fancy for perching on telegraph wires, on which all establish themselves close together, a few flying off and playing about, chasing insects, &c. I fancy they keep to one spot very much, and do not move about greatly. They build in February and March, and perhaps also later, always, so far as I have seen, near water, and very frequently on the banks of rivers. I found several nests on the Warda river, near Chanda, invariably beneath overhanging ledges of rock; 3 eggs ap-

pear to be the regular number. There is a peculiarity in all the nests I examined which I do not think has been noticed. They all are formed of mud and shaped like a saucer, open above. In the centre of the bottom there is invariably a small hole left. What is the object of this? Can it be cleanliness?

During the breeding season, these birds hunt up and down the stream keeping over the water or in its immediate neighbourhood.

85. **H. erythropygia**, Sykes. (*H. daurica*, L. apud Jerdon). On February 23rd, close to Wún, in southeast Berar, I saw an immense flock of these swallows flying about one spot on the ground and constantly alighting. There was no flight of winged ants or termites to attract them, and they might have been preparing to migrate or resting during migration. I frequently met with this species near Nágpúr.

86. **H. fluvicola**, Jerdon. I met with this bird 1st, at the marble rocks near Jabalpúr, 2nd, on the banks of the Kolar, at Saonair, a few miles north-west of Nágpúr, 3rd, close to the village of Gúgús, west of Chanda, on the river Warda. I gave an account of the nests, eggs and habits, in the Ibis for 1867, Vol. III. p. 462, and as this has since been copied by Mr. Gould in his "Birds of Asia," it is scarcely necessary to repeat it. The most curious point is, that the birds evidently return to the same spot every year to build, and this place is invariably beneath an overhanging bank over deep water. Mr. Gould represents them as breeding against a high cliff. This may occasionally happen, but is unusual.

I found in one place on the Pem Gunga a deserted colony. Several nests had been half built and abandoned. The cause was evident, the place which in former years had been a deep pool had partially silted up, and the nests were accessible, and doubtless no longer secure from predaceous animals. Nevertheless a pair of *Cotyle concolor* had bred in one of the deserted nests, which contained two of their young.

90. **Cotyle (Ptionoprogne) concolor**, Sykes. I have just mentioned this bird breeding in a deserted nest of *Hirundo fluvicola*. The shape of the nest was unmistakable, it was only half finished and open above. I obtained the eggs on two or three occasions. They were more oval and more closely spotted than those of *H. fluvicola* and *H. ruficeps*.

The nests were so precisely similar to those just described, made by *H. ruficeps*, that as they are in exactly the same situation, it is possible they might have been built by that bird, and only occupied by the *Cotyle*. They had the usual hole at the base. It would be interesting to know if anybody else has observed parasitic nidification in this bird.

91. **Cotyle (Ptionoprogne) rupestris**, Scop.

On the 4th of February I saw two distinct species of crag martin flying about the lofty cliffs around a hill near Perzágad, about half way between Chanda and Nágpur. One was *C. concolor*, the other conspicuously larger. The next day I saw the latter again, consorting with *Hirundo erythropygia*, and succeeded in shooting a specimen which proved to be *C. rupestris*. I again found this bird far from rare at Khandala, Karli, and the neighbourhood between Poona and Bombay, at the end of October. It is evident, therefore, that its range in the peninsula of India is not confined to the higher hills.

This species abounds in Abyssinia, and I have seen it as low down as about 2000 feet above the sea, much as in India. It always keeps very much to craggy hill sides.

Family MUSCICAPIDÆ.

293. **Leucocerca leucogaster**, Cuv. (*L. pectoralis*, Jerdon). I shot this bird near Chanda in forest. It appears in Dr. King's Goona list, while the much more widely distributed *L. aureola*, Vieill., (*L. albofrontata*, Frankl.) does not. My specimens are dusky on the back and rather rufous on the abdomen.

295. **Cryptolopha cinereocapilla**, Vieill., common in every mango tope and grove of large trees about Nágpur.

297. **Alseonax latirostris**, Raffles. Specimens from near Chanda appear to agree but with this race. It is scarce. I cannot see the smallest difference between the specimens collected by me and one sent from Amoy by Mr. Swinhoe as *Muscicapa cinereo-alba*, Temm.

306. **Cyornis Tickellæ**, Blyth. I obtained 2 specimens of this rare bird, one at Seoni between Jabalpúr and Nágpur, the other

near Chanda. The first was a female,\* but the plumage was precisely similar to that of the male.

310. **Muscicapula superciliaris**, Jerdon. A solitary specimen was shot by the Museum Collector who was with me about half way between Nágpur and Chanda.

311. **Erythrosterna acornaus**, Hodgson. I obtained a solitary specimen of this bird also. It has not, I believe, before been recorded from the plains. My specimen, a female, was killed at Seoni on the road from Jabalpúr to Nágpur in a mango tope. It is identical with the type specimens received from Mr. Hodgson in the Indian Museum, but it does not agree well with Jerdon's description, the back being bluish cinereous, sides of breast cinereous grey, middle of breast, throat, and belly white with a pale rufous tinge. The head and neck are dark ashy, forehead rufous close to the bill, wing  $2\frac{1}{2}$  inches, tail  $1\frac{9}{10}$ .

323. **Erythrosterna parva**, Bechst. Common about Nágpur. I did not obtain a single specimen of *E. leucura*, which is probably only found in Bengal and Orissa, like some other migratory birds. In *E. parva* the buff feathers round the orbits are peculiarly conspicuous.

Males shot as early as the end of November had the red breast, so that except in birds of the year, I doubt if the male ever has the plumage of the female.

#### Family CAMPEPHAGIDÆ.

268. **Volvocivora Sykesii**, Strickland. Not rare in some of the woods near Sironcha, but I saw it nowhere else. The clear whistle mentioned by Jerdon is most peculiar. I heard it several times in the beginning of May.

277. **Pericrocotus erythropygius**, Jerdon. Not very rare in the open country about Nágpur.

The representation of this bird by *P. albifrons*, Jerdon, in Upper Burma, is a parallel case to the replacement of the *Malacocerci* by *Chattarhæa gularis* and of *Francolinus vulgaris* and *F. pictus* by

\* I did not unfortunately myself examine the specimen, and its sex was determined by the native skinner who was with me, but as I repeatedly tested his determinations, and always found them correct, I see no reason to doubt its accuracy.

*F. Phayrei*. There are other cases of the representation in Upper Burma alone of Hindustan species, not found in the intervening country.

Family DICRURIDÆ.

281. *Dicrurus cærulescens*, L. This bird is not rare about Nágpúr.

Family LANIADÆ.

257. *Lanius erythronotus*, Vigors. This bird varies greatly in size and somewhat in plumage within the same district, and at one time I thought I had two distinct races, but I subsequently shot intermediate forms. In some the black frontal band is as broad as in Himalayan specimens, in others it is completely wanting. The wing varies from 3.4 to 3.7, tail from 4 inches to 5, and the amount of rufous on the lower back is scarcely the same in any 2 specimens.

Family CRATEROPIDÆ (*Timaliidæ*.)

Subfamily *Timaliinaæ*.

Unquestionably Jerdon's correct in raising *Timalia* and its allies to the rank of a family, but I confess that I cannot see why the very closely allied *Drymoicinæ* should not be included, as has been done by Blyth. Jerdon's main objection,—their less social habits—is not by any means a universal criterion. *Megalurus palustris*, for instance, is a solitary bird, and so, very often, is *Timalia pileata*, while I found *Prinia gracilis* in small families just like *Malacocercis* and a small *Drymoica* which I shot on the coast of the Red Sea occurred in precisely the same manner. I cannot understand why *Crateropus* is removed from this family by Newton.

397. *Dumetia hyperythra*, Franklin. Shot near Chanda in bushes beside a river.

423. *Trochalopteron cachinnans*, Jerdon. By some mistake, Jerdon has assigned white lores and chin to this bird; they should be black. It is extremely common on the Nilgiri hills.

423a. *T. Fairbanki*, n. sp.\* *Persimile T. Jerdoni, sed capite insuper fusco, haud cærulescente coloris margine distincto; dorso olivaceo, mento, gula, collo, pectore griseis, lateribus colli cinereis, medii pectoris*

\* The author has arranged, at his own expense, for a coloured drawing of this interesting species, to be executed at home, and it is to be hoped that the plate can be issued with the next number of this year's Journal, should it not arrive in time for issue with the present number. [ED.]

*pennis fusco centratis, abdomine subcaudalibusque ferrugineis. Statura ab illâ T. Jerdoni non discrepante.*

*Habitat in montibus Pulney, Indiæ meridionalis. Detexit S. Fairbank.*

Head above dark brown, the margin of the colour distinct and not passing into anything else on the nape, but distinctly contrasting with the olive colouring of the back; lores, which are small, and a narrow streak running back from the eye dusky; supercilia and orbital feathers white; back olive, rather lighter towards the rump, wings and tail rather darker. Beneath the chin and throat with the sides of the head below the eyes rather pale grey, the feathers of middle of the breast the same but with dark stripes in the centre; sides of the neck ashy, this colour passing far back close to the dark brown of the head; whole abdomen and lower tail coverts ferruginous, flanks and thigh coverts olivaceous.

Beak dusky, legs dark plumbeous. Dimensions the same as those of *T. Jerdoni*, wing 3.4, tail 3.7, bill at front 0.7 inch.

In Proc. Z. S. for 1867, p. 834, I mentioned my impression that the grey-breasted *Trochalopteron* of the Pulney hills collected by Mr. Fairbank was distinct from *T. Jerdoni* from the Wynaad. This impression was due to some slight differences from the description in Jerdon's Birds of India, and also to the *a priori* probability that two birds living on isolated hill ranges would prove distinct, since the intervening range of the Nilgiris in which neither are found, is inhabited by the very different *T. cachinnans*. Unfortunately the specimen of *T. Jerdoni* which formerly existed in the Asiatic Society's Museum has disappeared, and I am unable to make a direct comparison, but in a drawing which Dr. Jerdon shewed me the other day, *T. Jerdoni* is represented with a distinct black chin like *cachinnans*, of which there is not a trace in *T. Fairbanki*. The other differences to which I alluded are the head being dusky above instead of bluish, and distinctly separated from the olivaceous back instead of passing into dull ashy on the nape; the centre of the breast being paler in the Pulney species, and the rufous colouring of the parts extending to the under tail coverts, which, in *T. Jerdoni*, are olivaceous like the flanks. Another distinction appears to be indicated by the drawing, *viz.* that in *T. Jerdoni*, the grey extends much further down the breast, and

the rufous colour of the abdomen is paler. In *T. Fairbanki* the latter is of the same colour as in *T. Cachinnans*, but such differences as these might be due to bad stuffing or incorrect drawing. No native artist, however, would have put in a black chin.

The habits are doubtless precisely similar to those of *T. Cachinnans*. I learn from Mr. Fairbank that the bird abounds on the Pulney hills. I suspect the Anamullay and Travancore ranges may yet yield several interesting novelties when closely searched. They are at present less known than any other part of the Indian peninsula, and judging from the comparatively large number of animals already known to be peculiar to them and to the Malabar coast, they are well deserving of close examination.

435. **Malacocircus Somervillei**, Sykes. Abundant at Khandalla on the top of the Bhore Ghat, and therefore at the edge of the Deccan. Further inland it is replaced by *M. Malabaricus*, Jerd.

In the course of 1867, I shot every species of *Malacocircus* known; *M. terricolor* in Calcutta, *M. griseus* at Coimbatore, *M. Malabaricus* and *M. Malacolmi* about Nágpur and Chanda, and *M. Somervillei* at Khandalla.

#### Sub-family *Drymoicinæ*.

530. **Orthotomus longicauda**, Gm. I shot a specimen of this tailor bird, with a paler grey breast, in Chanda forest. It does not appear to differ from the common form in any other respect, and may, therefore, not improbably be an individual peculiarity.

533. **Prinia Adamsi**, Jerd. Mr. Fairbank informs me that he has procured this species near Ahmednuggur in the Deccan.

534. **Prinia sonalis**, Sykes. Pem Ganga valley near Chanda. I believe it was this race which I killed, it seems a little larger than *P. Stewarti*, but the two forms are not easy to distinguish. This species and the next are included in Dr. King's list of Goona birds.

536. **P. gracilis**, Franklin. Forest close to Chanda. I found this bird in small flocks of 5 or 6, like *Malacocirci*, hunting about amongst the branches of trees, and flying consecutively from tree to tree, just as the restricted *Timaliinae* do. I see Captain Beavan, Ibis for 1867, p. 454, has also noticed the occurrence of this bird in flocks and its habits.

## Family BRACHYPODIDÆ.

In the classification I have mainly followed that of Newton, the *Oriolidae* are classed as a distinct family, while the bulbuls are associated with the true thrushes. As *Phyllornis* is unquestionably a link between the bulbuls and orioles, while there does not appear to be any equivalent link between them and the thrushes, I believe that, with respect to the birds of India at all events, Dr. Jerdon's classification is as sound as it is convenient.

452. ***Ixos luteolus***, Less. Occasionally seen, and one or two specimens obtained near Chanda.

460. ***Otocampsa fuscicaudata***, Gould. This race extends northwards along the Western Ghats, like many other Malabar forms, and I shot it at Khandalla. I never saw an *Otocampsa* in Central India.

One of the forms with yellow lower tail coverts, perhaps *Ixos xanthopygius* H. and Ehr., occurs at Lahej near Aden.

467. ***Iora zeylanica***, Gm. I found this common bird near Chanda. Between Chanda and Nágpur I killed a specimen perfectly intermediate between *I. zeylanica* and *I. typhia*.

470. ***Oriolus Kundoo***, Sykes. I obtained a nest from the topmost branches of a banyan on the 29th April, with some fragments of egg shells in it, the eggs had been broken in securing the nest. It was a very neat cup-shaped structure, almost entirely formed of hairy sheep's wool, but with a snake's cast-skin interwoven, as is so commonly the case in *Thamnobia* nests.

473. ***Oriolus Ceylonensis***, Bon. A specimen of this bird was obtained by my friend, Dr. Bühler, at Nasik, and I have quite recently heard from Mr. Fairbank, that he has shot it a few miles north-west of Ahmednuggur in the Deccan. Like other Malabar forms, it doubtless ranges for a considerable distance to the northward along the Western Ghats, and thence occasionally wanders into the Western part of the Deccan.

## Family TURDIDÆ.

I include the *Saxicolinae* and *Ruticillinae* in this family, as some of the older writers did and as was done by Mr. Blyth. It appears to me that woodland forms, like *Janthia*, come very close to *Callene*

*Brachypteryx*, &c. The African *Thamnolæa* is quite as much like a thrush as a *Saxicola*, while on the other hand there is a complete break between both the subfamilies mentioned and the typical *Sylviadae*. If *Grandala* is not a thrush, it should be put with the Starlings as the very closely allied *Lamprotornis leucogaster* of Africa is.

353. **Oreocætes cinclorhynchus**, Vigors. I saw this bird for two consecutive days, 4th and 5th April in high forest about 20 miles south-east of Chanda, and I shot one specimen. I suppose all that I saw were migrating, as I met with none afterwards. Jerdon says it feeds on fruits and berries. The bird shot by me had *coleoptera* and large black ants in its stomach.

354. **Geocichla cyanotus**, J. and S. This bird is occasionally met with in the forests around Chanda. At Khandalla between Bombay and Poona, I shot a specimen with an olive green back. In the Indian Museum I find specimens of *G. citrina* similarly coloured. Jerdon says, the female of *cyanotus* is less purely coloured than the male, and that of *Citrina* is olivaceous. The olive green colour is certainly not sexual in the former and I doubt its being so in the latter. I am inclined to think that the olive coloured birds are young. I did not meet with *G. citrina* in the Central Provinces.

356. **Geocichla unicolor**, Tickell. I shot this species also at Khandalla, but did not meet with it in Central India.

342. **Myiophonus Horsfieldii**, Vigors. Not rare on the crest of the Western Ghats as far north as Bombay. I shot only one specimen, but I saw others at Khandalla. Mr. Fairbank told me that he had obtained the nest on the Pulney hills close beside a deep pool in a stream, just like the one described by Jerdon.

It is rather surprising that this bird does not occur in Sykes's list which, however, is far from complete.

342a. **Callene albiventris**, Fairbank, Pulney hills figured in P. Z. S. for 1867, p. 832, Pl. XXXIX. and again by Gould, Birds of Asia, Pt. XX. The egg evidently resembles that of *C. frontalis* described by Blyth from Hodgson's drawings. Ibis for 1866 II. 373.

Blyth describes the females of both, *Callene rufiventris* and *C. frontalis*, as dull coloured. The specimen of the female of *C. albiventris* was so little paler than the male that I was inclined to consider

the difference due merely to the state of the plumage. The sex had been ascertained by Mr. Fairbank by dissection.

488. **Saxicola opistholeuca**, Strickland (*S. leucuroides*, Guer. apud Jerdon.) I shot a single male bird close to Nágpur. It has not I believe previously been found south of the Nerbudda. The same remark applies to the next species.

492. **Saxicola atrogularis**, Blyth. Of this bird I killed 3 specimens, 2 males and a female within a few miles of Nágpur on open waste ground.

**Saxicola**, sp. I shot a female *Saxicola* close to Nágpur which I could not identify with any known Indian species. It was much less rufous than *S. atrogularis*. I cannot find the specimen now.

479. **Thamnobia fulicata**, L. I found a curious nest made by this bird, and in a singular position, *viz.*, inside the bamboo of a dhooly in the veranda of Captain Glasfurd's house at Sironcha. The principal material of which the nest had been composed, was a number of short fragments of string, with these were grass, horse-hair and a snake's skin. The nest contained 3 eggs as usual.

*Saxicola melæna* of Rüppell has very much the appearance and habits of the Indian *Thamnobia*, and has precisely the same trick of jerking its tail.

#### Family SYLVIADÆ.

After separating from this group the *Drymoicinæ* which I believe should be placed in the *Timalidæ*, and removing the *Saxicolinæ* and *Ruticillinæ* to the *Turdidæ* there still remain the *Motacillinæ* which have even less affinity with the true Sylvians than the wren warblers and stone chats shew, and which are classed separately by most ornithologists. The *Calamoherpinae*, *Sylviinæ* and *Phylloscopinae* form a thoroughly natural family, similar both in form and habits.

515. **Acrocephalus brunnescens**, Jerd. This prince of skulkers is as difficult a bird to secure as any I know of. One when badly wounded got away from me in a small open bush on the banks of a river, where, so far as I could see, its only possible plan of disappearing was by diving amongst the roots. I only obtained one specimen in the Central Provinces, though I frequently heard the sharp single call from bushes beside water,—a favorite resort.

The specimen I obtained, a female, has the first long primary only  $\frac{1}{16}$  inch shorter than the second, otherwise it agrees pretty well with Jerdon's description. It, however, differs from the Calcutta specimens in the Asiatic Society's Museum, not only in the proportions of the wing, but also in being much whiter below, and in having a distinctly defined whitish eyebrow, with a strong white line extending to the base of the upper mandible. The rump too in the Chanda specimen is distinctly paler than the back, not so in those from Bengal.\*

516. **Acrocephalus dumetorum**, Blyth. Not very rare about Chanda, in bushes. I also shot it at Khandalla on the top of the Western Ghats. I never saw it near water.

568. **Phylloscopus indicus**, Jerdon. I obtained two or three specimens of this bird, and saw it frequently in the low scattered jungle between Nágpur and Chanda, but not in the forests south and east of the latter place. It is a most active little bird, clinging to stems, and running up and down them in all directions like a *Sitta*.

The other *Phylloscopinæ* which I obtained about Nágpur and Chanda were *Phyllopneuste rama*, *Phylloscopus viridanus*, *P. nitidus*, *P. lugubris*? and *Reguloides superciliosus*. Of *Sylviniæ* I shot *Sylvia orphea* and *S. curruca*.

#### Family PARIDÆ.

645. **Parus cinereus**, Vieillot. The specimens of this bird which I shot in Central India differed so much from Jerdon's measurements and description that I could not but believe, that they belonged to a distinct species. On comparing them, however, with Himalayan specimens, I found them perfectly identical, and there was no perceptible difference between them, and Gould's figures in the Birds of Asia. It struck me, as this bird is very abundant on the Nilgiris, that Jerdon might have taken his measurements from the race occurring there, which would consequently be much larger than the plains species, and on obtaining the Nilgiri form, I found that this was the case, except that the lengths given for the beak and tarsus must be misprints.

\* Other specimens from the neighbourhood of Calcutta, which I have seen since this was written, exactly resemble that from the Central Provinces, and I find that in that specimen, the proportions of the primaries in one wing differ slightly from those in the other.

Jerdon omits to mention the white nuchal spot and the white on the outer tail feathers. The black line below is continuous throughout from the beak to the point of the tail. I append the measurements of the two races.

|                     | Chanda.          | Nilgiri.         |
|---------------------|------------------|------------------|
| Whole length, ..... | Barely 5 inches. | Nearly 6 inches. |
| Wing, .....         | $2\frac{1}{2}$   | $2\frac{8}{10}$  |
| Bill at point,..... | $\frac{1}{3}$    | 0.37             |
| Tarsus, .....       | $\frac{7}{10}$   | $\frac{7}{10}$   |
| Tail, .....         | $2\frac{1}{4}$   | $2\frac{3}{4}$   |

The size of the Nilgiri race, however, is somewhat variable, some specimens are smaller and appear to form a passage into the plains race, so I can see no need for proposing a new name, although the difference appears quite as great as in the case of *Pratincola caprata* and *P. atrata*. The bill especially in the Nilgiri variety appears to vary in size.

*P. cinereus* is not very rare in the forests on the Pranhita and around Chanda, I found insects in their stomachs. In April the sexes were in pairs, playing about on the trees with a peculiar low whistling note. They could scarcely have been breeding, for many of them, although paired, were moulting, but doubtless they do breed in the plains. I saw them, still in pairs, as late as the middle of May.

648. **Machlolophus Jerdoni**, Blyth. I shot this bird at Jabalpúr, and again near Nágpúr, and saw it at rare intervals on the Pranhita and Godavery, everywhere very rare.

#### Family ALAUDIDÆ.

I cannot see why the *Motacillinae* should form a distinct family, unless the pipits be excluded, for which there is no good reason. In form, plumage and habits there is less difference between *Alauda* and *Corydalla* or *Agrodroma* than between *Saxicola* and *Pratincola*, or *Fulco* and *Accipiter*. The bill is extremely variable amongst the typical *Alaudidæ*, varying from the finch-like form of *Pyrrhuloxia* to the long bill of *Certhilauda*, and in flight these two forms differ more from each other than do the skylarks and titlarks. The long hind claw of *Budytes* can scarcely be an adaptive modification, for the species in which it is most developed is less similar in its habits to the larks than other species which have shorter hind claws.

591. **Motacilla personata**, Gould and **M. dukhunensis**, *vera* Sykes (not of Jerdon). I obtained both these races in the Central Provinces. The former I only shot, at and near Nágpúr, in December and January, the latter both near Nágpúr and also near Chanda in March. As I was then on the look out for specimens in breeding plumage, and shot those with most black about the head, I should not, I think, have overlooked *M. personata*, had it occurred. The two are not very difficult to distinguish even in winter plumage.

In Bombay and at Khandalla, in October and November, I only met with *M. dukhunensis*. In this race, the black cap in the male is persistent.

I am unable to distinguish birds shot in Abyssinia from *M. dukhunensis*.

Captain Beavan's Umballa and Simla *Motacilla luzoniensis*, Ibis, 1868, pp. 76, 77, is probably *M. personata*.

The distribution of these races of *Motacilla* is very singular and deserves most careful observation. In some cases the migratory forms of Bengal are the same as those of Burmah and China, and distinct from those of Western and Southern India, as in the two forms of *Erythrosterna* and probably in some other instances, but here is the apparent case of a third race intervening, for hitherto *Motacilla personata* does not appear to have been detected either in Bengal or Bombay.

602. **Agrodroma campestris**, L.

604. **A. sordida**, Rüppell.

I obtained both of these large pipits near Nágpúr. The last named appeared to be the commoner, and I frequently saw it in stubble fields of "Thúr" or "arhar" (*Cajanus indicus*) and similar places.

768. **Alauda Malabarica**? Scop. This bird is very imperfectly described. I found a crested lark abundant at Khandalla, which I at first thought was *Galerida Boysii* of Blyth, as the measurements agreed, although the coloration is different from that of *G. cristata*. But I find the type of *G. Boysii* is still in the Asiatic Society's collection, and that it has precisely the plumage and bill of *G. cristata*.

On shewing the Khandalla lark to Dr. Jerdon, he immediately recognised it as the bird he had identified with Sonnerat's *alonette*

*huppée de la côte de Malabar* (*A. Malabarica* of Scopoli). On turning to Sonnerat's Voyage, pl. 111 (not 113 as quoted in Jerdon's Birds of India) I find the chief peculiarity of the lark there figured, is the very broad pale edges to all the feathers, and in the accompanying description, it is stated that the crest is tipped white, and the feathers of the back and wing coverts are broadly tipped with rufous. I cannot find a copy of Scopoli's work: Latham merely copied from Sonnerat, even translating *cinq poudces, neuf lignes* by  $5\frac{3}{4}$  inches which, considering that the French *pouce* is not the English inch, is of course not quite accurate.

Now the Khandalla bird has neither white tips to the crest feathers nor broad rufous edges on the back and wing coverts. In size, bill and colouring it closely resembles *A. gulgula*, the principal differences being that it has a pointed erectile crest on the top of the head as in *Galerida*, and that it has precisely the proportions of the wing primaries of that genus. The plumage above is scarcely distinguishable from that of *A. gulgula*, below the breast spots are larger and more numerous and the abdomen is paler. Jerdon says *Alauda Malabarica* is somewhat smaller than *A. gulgula*, and the general tone of colouring much more rufous. Now the Khandalla bird is, if anything, less rufous, certainly less so than the Nilgiri race of *A. gulgula*.

Again Mr. Blyth in his commentary on Dr. Jerdon's birds of India in the Ibis for 1867 says that *Alauda œlivox* of Swinhoe is nearer to *A. Malabarica* than to *A. gulgula*. There is a specimen of *A. œlivox* in the Indian Museum sent, I believe, by Mr. Swinhoe himself, and whilst it so clearly resembles *A. gulgula* that I am unable to appreciate the difference, it is not in the least like the Khandalla lark.

The very imperfect specimen in the Indian Museum, labelled *A. Malabarica* by Mr. Blyth and presented by Dr. Jerdon, is in so bad condition that I can only say, it is not the Khandalla bird. It may be *A. gulgula*, the Nilgiri variety.

I have in one or two cases shewn that Malabar birds range north along the Western Ghats, so that it is by no means improbable that this lark also inhabits Malabar. If we suppose, which is probable, that Sonnerat's figure is simply a caricature, as the adjoining print on the same page of *Pyrrhulauda grisea* most certainly is, and that the description was taken from the picture, and not from the bird, (the only

difficulty concerning which is the measurements,) it appears highly probable that Dr. Jerdon was perfectly right, and that this bird is really the Malabar lark. I think this is a more satisfactory view than to propose a new name for the Khandalla bird on the chance of its being distinct, though I fear the latter is the usual practice with some ornithologists. I grant that Sonnerat's figure resembles *Spizalauda deva* and the Nilgiri variety of *Alda gulgula* quite as much as it does the present species, but until it has been clearly proved which of the three is the common crested lark of Malabar, it is best not to alter the existing nomenclature on the chance of its being wrong. I accordingly give a description of the Khandalla bird, which may stand as *A. Malabarica*, until it is proved that that bird is a distinct species.

Top of head with lengthened pointed crest very dark brown, the feathers very narrowly edged but not tipped with fulvous. Sides of head and back of neck much lighter in colour than the cap, rather pale fulvous supercilium, lores rather darker, and ear coverts also. Back and sides of neck rufescent fulvous with rather broad median dusky streaks, and the feathers not broader near the base than towards the point. Back and wing coverts deep brown with very narrow greyish edgings, some of the greater coverts more broadly margined. Quills dusky brown, primaries and secondaries rufous on the inner edge and more narrowly externally, under wing coverts also rufous. Tail middle feathers dusky with pale margins, the remainder deep blackish brown, all narrowly tipped fulvous, the outermost but one with a broad fulvous margin and the outermost almost entirely fulvous. Beneath, chin and upper throat dirty white, breast pale fulvous with broadish dusky streaks forming the centre of each feather, a dark patch on each side of the neck just where the streaks begin; abdomen and under tail coverts fulvescent.

Length (taken in the flesh)  $6\frac{1}{4}$  inches, wing  $3\frac{3}{4}$ , tail 2, tarsus  $\frac{7}{8}$ , bill at front  $\frac{9}{16}$ , hind toe 0.3, claw 0.4. In other specimens the wing is only  $3\frac{1}{2}$  to  $3\frac{5}{8}$ .

765. **Spizalauda deva**, Sykes. This bird must be rare about Nágpúr and Chanda, for I only once obtained a specimen which was shot near Edlábád, west of Chanda.

766. **Mirafra erythroptera**, Jerdon. I met with this bird not unfrequently in low jungle and on the skirts of the forest

country near Chanda. Jerdon's description of its habits, as usual, is excellent.

757. **M. cantillans**, Jerdon. I only came upon this bird once in a wild tract of grass with scattered bushes, about 50 miles west of Chanda. Over a small tract of country extending for a few miles along the road it abounded, but no where else. I did not observe any other *Mirafra* besides these two.

758. **Ammomanes phœnicura**, Franklin. Extremely abundant in the open country about Nágpur and Chanda. I have occasionally seen it perch.

#### Family PLOCEIDÆ.

Dr. Jerdon refers to the occurrence of *Ploceus hypoxanthus* at Rangoon and Thayet Myo. I also shot it at Mandalay (Ava).

765. **Estrela formosa**, Lath. I met with this rather scarce bird in the Chanda forest and again on the Pranhita near Ahiri, always in or near forest.

The only other *Estrelidæ* collected in Central India were the common *E. amandava*, *Munia undulata* and *M. Malabarica*.

#### Family FRINGILLIDÆ.

716. **Emberiza Huttoni**, Blyth. I obtained this bird both at Chanda and Nágpur, and Mr. Fairbank informs me that it is common on rocky hill sides near Ahmednuggur. It is highly probable that it has been mistaken for *E. hortulana*.

Dr. Jerdon, Birds of India, p. 380, mentions my having shot *Emberiza rutila*, Pallas, in Upper Burma. This is a mistake. I shot the only specimen obtained in Pegu at the base of the Arracan hills, west of Henzada.

721. **Euspiza melanocephala**, Gm. I found this bird much less common about Nágpur than the next species. Jerdon does not describe the female. It has the head above including the ear-coverts and back brownish grey with dark mesial streaks to the feathers, very faint on the head; rump grey, mixed with yellow, wing-coverts, quills and tail feathers dusky, edged with fawn colour, the tertiaries and greater coverts very broadly so; chin, throat and breast pale fawn colour, abdomen yellowish white, under tail coverts bright yellow. Bill horny, paler beneath, feet brown.

722. **Euspiza luteola**, Sparrman. Very common about Nág-púr, less so further south. The female is dull coloured, like that of *E. melanocephala*.

711. **Passer (Gymnoris) flavicollis**, Franklin. About small villages in the jungle this species very often entirely replaces the common sparrow, but it is also found in the wildest jungles far from any human habitation. I entirely fail to see any good grounds for its separation as a distinct genus from *Passer*.

#### Family CORVIDÆ.

660. **Corvus culminatus**, Sykes. This bird is said frequently to point out where tigers and leopards are lying by perching on the trees over them, and cawing. I have never seen an instance myself, except when the tiger has killed an animal, and the crows are attracted by the carrion. The birds are, however, very watchful and often perch above men; and I have been annoyed by them when trying to shoot birds, so they may very possibly follow tigers at times, somewhat as the *Presbytis* monkeys do.

#### Order GEMITORES.

##### Family TRERONIDÆ.

772. **Crocopus phœnicopterus**, Lath.

773. **C. chlorigaster**, Blyth.

Birds shot at Nág-púr were perfectly intermediate between these two races; one has the green forehead and the green of the tail of *C. phœnicopterus*, another the green forehead only and both have the yellowish green belly of *chlorigaster*. There are also intermediate forms, killed by Captain Beavan in Manbhúm, in the Indian Museum. Birds procured at Chanda were pure *chlorigaster*.

I am inclined to look upon Dr. Jerdon as right in considering all these intermediate forms as fertile hybrids; they are always found where the two races meet, and where the two differ so little as in the green pigeons, the rollers and Kallij pheasants, they doubtless breed together freely.

I found the nest and two very young birds of *Crocopus chlorigaster* near Sironcha on May 11th. The nest was exceedingly small, a little platform, of sticks very loosely put together on the branch of a perfectly bare tree.

780. **Carpophaga sylvatica**, Tickell. I am obliged to dissent from Dr. Jerdon's account of the distribution of this bird. He says—it inhabits the whole of India in forest countries. Now this is constantly asserted of Malay forms, and I am persuaded that in many cases it is a mistake. I have been all through the immense forests of the lower Nerbudda and Taptee valleys, and I never saw an imperial pigeon in them, nor did I ever meet with the bird near Chanda. I first came upon it near Sironcha and thence it occurred down the Godávery, and I have shot it in Orissa. My belief is, that its range is rigidly restricted to the great forest country inhabited by *Gallus ferrugineus* and *Rucervus Duvaucelii*, and that it does not occur in the woods of Central\* or Western India. This makes it the more probable that Mr. Blyth's *C. pusilla* is a really distinct race, confined to Malabar, or perhaps like other Malabar forms ranging northwards along the Western Ghats. It may also occur on the hill plateaus about Salem and Trichinopoly. In the same manner I have scarcely a doubt but that Jerdon's *C. cuprea* will prove, when compared, distinct from *C. insignis*, Hodgson.

I also never yet saw an *Osmotreron* nor a *Chalcophaps* in the country west of Nágpúr, or in the Nerbudda valley. I much regret now that I did not collect birds in the Nerbudda and Taptee valleys, as I might have noted several interesting points regarding their distribution.

#### Order RASORES.

##### Family PTEROCLIDÆ.

803. **Pterocles fasciatus**, Scopoli. I can confirm Dr. Jerdon's account of the crepuscular habits of this bird. For two or three years I noticed occasionally, when camped beside streams in jungle, that some bird frequently flew along the course of the stream with a most peculiar tri-syllabic cry, after dark in the evening, or before it was light in the morning. At last I caught sight of the bird one morning, and recognised it by its flight as a *Pterocles*, and as *Pt. exustus* is never found in forest, it must have been *Pt. fasciatus*. The closely allied *Pt. Lichtensteini* occurs in immense numbers near the Abyssinian coast, and this also flies to water in the dusk of the morning and even-

\* When Jerdon speaks of this bird's breeding in Central India, I believe he means Bastá, not Nágpúr, and still less Málwa.

ing, not in the day, as other sand-grouse invariably do, though I did not notice it as early in the morning, as I did *Pt. fasciatus*.

I occasionally met with *Pt. fasciatus* about Nágpur and Chanda, but it is much less common there than in Guzerat.

802. **Pterocles exustus**, Temm. I obtained the eggs close to Nágpur on December 27th, and again not far from Woon, north-west of Chanda on February 21st, 3 in each case. Jerdon says the central rectrices in the female are not elongated. It should be, are less elongated than in the male. The whole description of the female must have been taken from some other bird by mistake. The abdomen is quite different from that in the male being closely barred, the chin and throat are orange buff, breast isabelline with black spots, an imperfect blackish gorget, then a broad unspotted space, and then the closely barred abdomen.

#### Family PHASIANIDÆ.

803. **Pavo cristatus**, L. The train is rarely full grown before April. Peacocks not unfrequently shew the presence of a tiger by flying up one after the other from a particular spot in the jungle. In the hot part of the day, both animals resort greatly to the thickets of *jhow* or "bastard cypress" (*Tamarix indica*) in the beds of rivers.

812. **Gallus ferrugineus**, Gm.

813. **G. Sonneratii**, Temm.

For the relative distribution of these birds see J. A. S. B. for 1867, Vol. XXXVI. p. 199.

#### Family TETRAONIDÆ.

814. **Galloperdix spadicea**, Gm.

Common in the Taptee and Lower Nerbudda valleys, and in the jungles around Chota Oodipúr.

815. **G. lunulosa**, Valenc.

I have shot this bird a little west of Nágpur near Ellichpúr, but I never noticed it further west.

Precisely on the same grounds as Jerdon, *viz.* Geographical distribution, I come to exactly the reverse conclusion, *viz.* that *Galloperdix* is a form with African affinities allied to *Pternistes*, but it would take too long to give all my reasons here.

818. **Francolinus vulgaris**, Steph.

819. **F. pictus**, Jard. and Selby.

For relative geographical distribution, see J. A. S. B. for 1867, p. 200. I have since been assured by Captain St. John, that he has shot *F. vulgaris* close to Khandalla. I cannot help thinking he must be mistaken, though I believe he knows the two forms well.

In the Transactions of the Literary Society of Bombay, Vol. II, p. 216, Captain McMurdo asserts that there is a third partridge inhabiting the Wagur district of Cutch, distinct from both the painted and black partridges, but resembling the former. What can this be? Dr. Adams says the bird in the hills below Kashmir, differs from that in the plains. Lieutenant St. John assures me, that the Persian black partridge differs from the Indian. Are the two species confused under *F. vulgaris*?

828. **Perdicula erythrorhyncha**, Sykes. This bird has the habits of a *Perdicula* and not of a quail. Its range is wider than stated by Jerdon, I shot it to my surprise in high jungle between Chanda and Sironcha. I also obtained it at Khandalla close to Col. Sykes's locality.

## Family TURNICIDÆ.

I only shot one species near Chanda and Nágpúr, *Turnix taigoor*, Sykes.

## Order GRALLATORES.

## Family CHARADRIIDÆ.

841. **Rhinoptilus bitorquatus**, Jerdon. I mentioned my having seen this bird near Sironcha in the Ibis for 1867, p. 462. I did not obtain a specimen. The locality was in very wild open forest jungle about 15 miles east of Sironcha.

852. **Chettusia gregaria**, Pallas. I killed a specimen about 40 miles south of Nágpúr. I also saw this bird, or another species of *Chettusia*, near Nágpúr.

859. **Ædicnemus crepitans**, Temm. I have seen this bird in considerable numbers in Upper Burma, near Pagan. Jerdon does not mention its occurrence east of the Bay of Bengal. I think there must be a Burmese specimen in the British Museum from my collections, but I am not sure. It probably does not occur in Lower Pegu, in Arracan, or in the Malay peninsula.

## Family SCOLAPACIDÆ.

870. **Gallinago stenura**, Temm. I have never met with this bird in Western or Central India, though for two or three years I examined every bird I shot, and I doubt if it occurs there. It is not in Sykes's list nor in that of Dr. King. Beavan, Ibis 1868, noticed the early arrival of the snipe in Burma which I can confirm from my own knowledge. At Poona it never appears before the middle of October, and then the birds are all *G. scolapacina* so far as I know. I believe it will be found that the birds are almost as late on the Western coast about Bombay, at all events sportsmen do not go out to shoot them before October, and generally not before November, whilst around Calcutta very fair sport may be had in September. This is strongly in favour of *G. stenura* not occurring in Western India, for it certainly is the earliest to arrive in any numbers in Bengal. About Calcutta, *G. stenura* seems to disappear in December and January, doubtless migrating further to the south-east: I have lately in those months examined bags of 30 to 50 birds, without finding one specimen. It abounds again, I believe, in February and March.

## Family RALLIDÆ.

**Podica personata**, Gray. I suspect I saw this bird on the river at Beypûr. It is likely enough that this Malay form might occur in Malabar, and unless this were the bird, I cannot conceive what it could have been. It swam and looked something like a grebe, but flew away when approached. It was certainly neither grebe nor duck, and I suspect it was a *Podica*.

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*Descriptions of two new species, belonging to the genera VARANUS, and FERANIODES respectively, from near Agra; by A. C. L. CARLLEYLE, Esq., Curator, Riddell Museum at Agra.*

[Received 22nd February, read 3rd March, 1869.]

*Order.*—SAURIA.

*Family.*—VARANIDÆ.

*Genus.*—VARANUS.

*Species.*—**T. ornatus**, Carlleyle.\* (vide p. 196).

*Habitat.*—Neighbourhood of Sikandra, near Agra.

*Specific character.*—Ventral shields, from gular fold to loin, in 116 transverse series. Total length of specimen,  $29\frac{1}{2}$  inches. Length of body alone, from end of snout to root of tail,  $14\frac{1}{2}$  inches. Length of tail  $15\frac{1}{2}$  inches. Length of head, from end of snout to nape, 2 inches. Breadth of head above, from ear to ear, 2 inches. Circumference of body, at thickest part,  $6\frac{3}{4}$  inches. Length of fore leg  $3\frac{1}{2}$  inches. Length of middle toe with claw  $\frac{7}{8}$ th of an inch. Length of hind leg 4 inches. Length of second posterior toe with claw, (which is the longest,) 1 inch. The body of this specimen is longer, in proportion, than in either *V. dracæna* or *V. lunatus*.

*Description.*—Scales of the greater portion of the back oval and slightly, or obtusely, keeled. Scales on the rear of the neck round, very prominent—almost tubercular, pretty sharply keeled, and raised, in their centres, almost to a point. Scales of back between the shoulders. also pretty sharply keeled. The small shields of the abdomen and under side of tail, are of an oblong oval shape, with a slightly raised, gently rounded, boss, or convexity, in the centre of each, surrounded by a narrow depressed border. These convexities are

\* Mr. Carlleyle suggests that a new generic name be introduced for the land-*Varani* with a round tail. These have been already called by Fitzinger *Psammosaurius*, but the distinctions, as likewise those pointed out in some other forms of *Varani*, have not been by other naturalists considered sufficient to justify a generic separation. A thorough review of all the various species from different parts of the world would, no doubt, be very desirable, for it is at present difficult to accept several of the numerous generic names suggested, because they are generally adapted to certain type species only, and a discrimination between what is to be called a variation of a genus, or a section, or a sub-genus &c. is by no means easy. It seems rather certain that these limits vary in different species, and that they have to be determined in each instance according to the characters of the group of animals to which they refer. (ED.)

easily depressed by force, so as to form little shallow hollows instead; but the narrow border, surrounding each of them, still remains marked and unmistakable. Small shields of the breast and throat hexagonal, also with a central convexity and narrow depressed border. Shields of under side of hind legs, pentagonal, in other respects similar to the last. Shields of under side of fore legs the same, but much smaller than the scutes of the under sides of the hind legs.

Anterior frontal scales of head slightly keeled, transversely. Posterior frontal scales larger, but not keeled. Vertical scales,—a small circle of eight scales, with one in the middle of the circle,—in the centre of the vertex. Superciliary scales small and granular.

Scales in centre of chin long-shaped, but very small and granular, and arranged in regular longitudinal series, anteriorly converging.

There is a slight shallow, longitudinal groove in the centre of the upper surface of the snout,—which mesial, supra-rostral groove, though common to and peculiarly characteristic of all the *Varani*, is not noticed at all by Günther, in any of his descriptions, although it appears plainly enough in his plate showing an upper view of the heads of *V. dracæna*, *V. lunatus* and *V. nebulosus*.

The nostrils, in the present species, form an elongated, curved, and rather narrow slit, situated, on either side, about  $\frac{1}{4}$  of an inch in front of the eyes, and a little over  $\frac{1}{2}$  an inch from the end of the snout; or much nearer to the eye, than to the end of the snout.

The eyes are situated further forward, or nearer to the snout, than in either *V. lunatus*, or *V. dracæna*.

The ears are situated about  $\frac{3}{4}$  of an inch behind the eye.

*Coloration and markings.*—These are very peculiar, and the colours very bright and beautiful, when the animal is alive, or only recently dead; but the bright colours fade away very much, after the skin is stuffed and dried,—a change which gradually took place in the stuffed skin of the present specimen, little remaining but the black markings, the original yellow ground colour much faded, and some slight traces of the formerly existing orange tints, which *tout ensemble* of conspicuous hues, gave the animal quite a gaudy appearance, when it came first into my possession, quite fresh, or, indeed, then still half alive.

The upper surface of the snout is marked with some black dashes. Vertex and occiput of head black. Another line runs from below the eye to the ear. Another black line, or stripe runs from behind each eye, on either side, to a point above the ear, and then continues backwards, on each side of the nape, to the middle of the back of the neck, where it stops. These two lines, or stripes, thus converge, and nearly meet on the back of the neck. The ground colour on either side of the black stripe which runs from behind the eye is of a bright gamboge yellow, forming two longitudinal bands of yellow behind the eye, with the black stripe in the midst. A black stripe also runs, on either side, from the back of the ear to a point between the shoulders, where these two lines unite, forming an acute angle of which the apex is directed posteriorly. A single black stripe runs from the centre of the occiput backwards, to the centre of the angle formed by junction of the two black stripes which run from the ear to a point between the shoulders, and unites with these lines there, dividing the receding angle in the midst. Rudiments of smaller black lines, converging towards the same point, and pale inky, or ashy-black, shadings, appear between the larger converging stripes. From the apex of this posteriorly directed angle of black, between the shoulders, a narrow longitudinal black stripe runs backwards along the centre of the back, to near the root of the tail—but not quite reaching it,—tapering off more and more finely in a posterior direction, until it disappears above the lumbar region. Ground colour of the back of the neck, between the black stripes, a bright orange, when the animal is living, or but recently killed, (fading after the skin is stuffed). The sides of the neck and shoulders gamboge yellow, and marked with several round, blackish ashy coloured blotches, or *ocelli*,—two on the shoulders being the most conspicuous. Sides of body, and sides of back, marked with round gamboge yellow spots, or blotches, with ashy coloured cloudings between them. General ground colour of back, pale greenish ashy, mixed with bright yellow. No rings, or marks, on the under side of the throat, which is of a dirty white colour. Belly white.

Tail round, with not the slightest sign of any longitudinal ridge, keel, or crest,—and more thin and tapering than in either *V. dracæna* or *V. lunatus*.

Legs short; toes rather slender, and shorter, in proportion, than those of *V. lunatus*.

Head much flattened, or depressed.\*

Teeth 10 in upper, and 10 in lower jaw, short, conical, and slightly recurved.

This is a true dry-land *Varanus*: the only two individuals of this species which I have seen, having been found in the most dry, and dusty places possible, far removed from water; and both were found in the neighbourhood of Sikandra, not far from the high road from Agra to that place.

I would here take the opportunity of observing, with regard to *Varanus dracæna*, and *V. lunatus*, that I cannot imagine why Günther has called them "Water Lizards," as they have nothing to do with water, and are always found in the *driest* places!

I would also remark that *Varanus flavescens* has nothing in common with the above species, and should, I think, form the type of a separate genus, or sub-genus, as a link between the true land *Varani*, and the *Hydro-sauri*. For, being a decidedly aquatic species, *Varanus flavescens* has a strong and deep longitudinal ridge or "crest," on the upper side of the tail, almost like that of a *Hydro-saurus*. The head also is higher and more triangular than that of the true land *Varani*; and the scales of the body are larger, and so strongly and sharply keeled and pointed, as to form a most marked distinction. The dentition also is different.

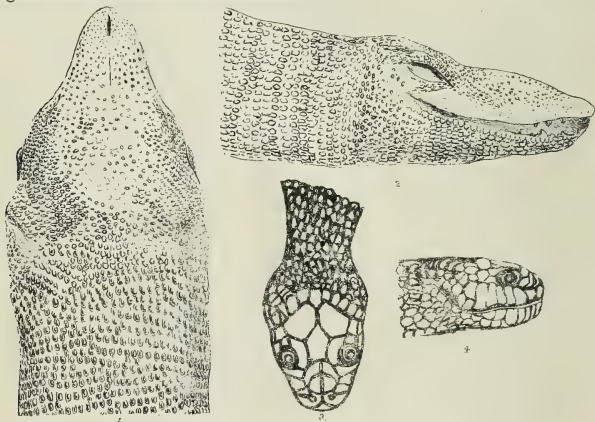
And *V. flavescens*, besides, has *not* the "central—supra-rostral groove," which I before mentioned as distinguishing the true dry-land *Varani*. Both *Varanus dracæna* and *V. lunatus* are very common about Agra; I have, therefore, had full opportunity of comparing my new *Varanus* with numerous specimens of those two common species. *V. nebulosus* is not found here.

I think Günther is mistaken in ascribing only "ninety" transverse series of scutes, from the gular fold to the loin, to *V. dracæna*; for all the specimens of that species which I have obtained here, have not

\* The photograph from which the sketch on p. 196 is taken shews the head to be remarkably broad and the snout short, what principally distinguishes this species when compared with *V. lunatus*, and other known Indian forms. Unfortunately the photograph is not clear and it was impossible to give much more than a correct outline of the head. (ED.)

less than 95 transverse series ! While in a specimen of *Varanus flavescens*, in my possession, on the other hand, I find only 67 transverse series (at most) instead of "70," as given by Günther ! I find, also, that *V. lunatus* has, more commonly, less than "105" series ; or, generally, about 103. The longest specimen of *Varanus lunatus* in my possession, measures 2 feet, 9 inches ; and the longest specimen of *V. dracæna*, 3 feet 6 inches.

It appears to be a law of nature, that the more terrestrial any species of *Varanus* is, the greater in number, and the smaller in size, are the transverse series of scutes, on the under side of the body ; and the more aquatic any species of *Varanus* is, the lesser in number and larger in size these series of scutes are.



Figs. 1-2. *Varanus ornatus*. Figs. 3-4. *Feranioides Jamnætica*

Order.—OPHIDIA.

Sub-Order.—COLUBRINI INNOCUI.

Family.—HOMALOPSIDÆ.

Genus.—FERANIOIDES (*Gen. Nov.*)

Species.—**F. Jamnætica**, *Carlleyle*.

Habitat.—River Jamna, near Agra.

Date of capture.—March, 1868.

Specific character.—Scales in 29 series. Entire length of snake, from

snout to end of tail, 2 feet, 1 inch. Length of tail  $3\frac{1}{4}$  inches. Circumference of body, at thickest part,  $2\frac{1}{2}$  inches. Length of head, from end of snout to nape,  $\frac{5}{8}$ th of an inch. Greatest breadth of head across,  $\frac{4}{7}$ th of an inch.

*Description.\**—Body thick, for the size of the snake. Head thick, broad, somewhat *Cerberine* in appearance, and distinct from the neck. Tail short, rather quickly but evenly tapering, and slightly compressed laterally, so as to form a sort of ridge on the back of that part.

Plates on top of head (posterior to nasals, and above eye) large posteriorly, and small anteriorly,

2        | |

2        | |

and arranged as 3 or | | | . Anterior frontal plates 2, triangular,

2        | |

with the two outer sides rounded. Posterior-frontal plates of a curved, diagonally elongated, or oblong, irregular pentagonal shape, situated (with regard to their greater axis) in a somewhat diagonal position to the central longitudinal line that divides the frontal plates in the midst. The anterior side of these post-frontal plates is concave. Vertical plate pentagonal, longer than broad, shaped like an elongated heraldic shield of which the lower point of the shield runs posteriorly, for about one quarter distance, between the two occipitals. Supraciliary plates (one over each eye) smaller than the vertical, of a sub-conic form, or semi-elliptical shape, curved over the eye, and truncated posteriorly, of which the broad base abuts posteriorly, against the advance of the two large occipital plates. These are very large, each an irregular sided hexagon (the two posterior sides of the irregular hexagon being very small, the other sides long,—especially the outer). No plates towards the nape; the nape being covered with multi-angular, pentagonal, quadri-

\* This interesting new species was pointed out to the author of this paper by Dr. T. C. Jerdon who, as stated in the Proceedings of this Society for March, p. 105, contemplated to describe the same in his forthcoming work on the "Reptiles of India," but who was so courteous as to disclaim the priority of publication, when requested for his opinion on the matter.—The snake principally differs from *Ferania* by its round pupil, and is in this respect one of the rare instances recorded among the HOMALOPSIDÆ, most of which have a narrow vertical pupil of the eye. The dentition would also appear to be peculiar, but on this point our information is as yet very deficient regarding a large number of our Indian snakes. (ED.)

lateral, and ovoid scales, of which the three most anterior and central ones are the largest and most conspicuous; the first central scale of the nape of the neck, which fits in at the posterior angle of the junction of the two occipitals, is pentagonal, and the largest. In reality, the occipital plates do not cover the whole of the back of the occiput proper, or do not reach to the nape; so that, the first dorsal (or rather cervical) scales are, in fact, situated on the occiput: and hence the head of this snake looks as if only the anterior half of its upper surface, were covered with plates, and the posterior half with scales. This is a strongly marked peculiarity which at once serves to distinguish this snake.

Nasal orifices narrow-shaped and curved, partially covered with a valve (capable of being closed over the orifice, when the snake is under water), the nasal slit being situated, in part, between two plates, *i. e.* the præ-nasal, and post-nasal; the præ-nasal plates (one on each side) being large, situated straight in front of the anterior frontals, and are shaped somewhat like an uneven disc of which a portion, posteriorly, has been cut out, leaving a sort of receding angle in the posterior margin of the plate. And each præ-nasal plate is also cleft posteriorly, from near its centre, by the nasal slit, thence making a short curve backwards to the line which separates the præ-nasals from the post-nasals. The latter are situated rather laterally, being small and oblong shaped. The rostral plate is pentagonal, shaped like a triangle rising from a parallelogramic base of equal breadth with the base of the triangle, and the apex of the triangle extends nearly half way back between the two præ-nasals. Upper labials, on right side 6, on left side 5; the third labial entering the orbit. The most posterior upper labial plates (the 6th labial plate on one side, the 5th on the other) very large. Posterior to the proper lateral upper labial plates on each side there is a largish sub-temporal plate placed above two small plates. Temporal plates, proper 4, small. Post-ocular plates 2, situated one above the other. Ante-ocular 1, curved, long transversely. Loreal 1, smaller, of an irregular shaped, quadrilateral figure. Median lower labials 2, very small, and situated one behind the other. Lateral lower labials 6, on each side, the two anterior lateral lower labials, on each side of the median lower labials, very long. Chin shields 2, very large.

Eyes, rather small, round; dark ash coloured, with a round white pupil.

Scales, smooth, not keeled, generally oval-shaped, and in 29 series.

Ventral plates proper, (from the throat to the anals and including throat plates,) 153. Præ-nasal plates 4, in pairs,—or in other words, two bifid plates. Post-nasal plates 7, in a transverse series of 4 and 3. Sub-caudal plates proper 100, in pairs. Total lower plates of under-part of body, 264.

*Colouring and markings.*—Markings on plates on the top of the head of a sort of puce, or olivaceous mouse-brown, or a muddy olive chocolate colour. A narrow yellowish white curved line runs longitudinally along the centre of each of the occipital plates, and extends to the nape. Anterior upper labials marked with dark blotches. A broad, dark olivaceous brown, narrowly-black-edged, stripe, runs along the cheeks, from the posterior upper labials, to beyond the gape, backwards, as far as the side of the neck. A yellowish-white stripe runs from the back of the eye to beyond the occipitals, as far as the back of the neck, on each side, posteriorly, and is again produced anteriorly as a narrow streak in front of the eye, then running round across the præ-frontals, (just behind the nasals) to meet the corresponding line on the other side; the angular curve of the streak as it crosses the front of the head, becoming lineally attenuated. There is a muddy olive chocolate coloured, longitudinal stripe on each side of the nape of the neck, on the scales which lie immediately at the back of each of the occipital plates, which unites anteriorly with the dark colouring of the head plates. A longitudinal broad stripe of the same dark colour, occupies the centre of the nape, which unites anteriorly with the dark colouring of the central head plates, and blends posteriorly with a large broad, oblong shaped, centrically narrowed, muddy olive-brown coloured, and narrowly black-edged blotch, occupying the whole of the back of the neck. A transverse, irregularly shaped, narrow, yellowish space, or band, runs off transversely, laterally on the neck, from each side of the dark nape mark, and divides the large dark blotch on the back of the neck,—on each side,—from the dark cheek stripe, and unites below with the yellow of the sides of the neck. A dark line runs longitudinally through the præ-oculars and nasals. Vertical shield of the same dark

colour. The whole of the dark markings on the top of the head, and centre of the nape, form a united figure resembling a barbed arrow-head, of which the shaft is broken off a little behind the posterior ends of the barb; the point of the arrow-head being directed forwards, and terminating on the præ-frontals.

Whole of back marked with large, broad, round, or oval-shaped, olivaceous mouse-brown or dark schistaceous olivaceous blotches, edged with black; these blotches are sometimes separate, or distinct from one another, and sometimes confluent,—and in the latter case they resemble some kinds of chintz pattern. The dorsal blotches become much darker towards the tail,—and, at length, become quite black cross-bands on the tail itself. Between each of these broad dark coloured blotches, there is a narrowish, greenish-yellow transverse band, which unites below with the bright yellow colour of the sides. Ground colour of sides, bright yellow, but marked with a double line of lateral dark, lozenge-shaped and irregular shaped spots, large and small, of the same colour as the transverse blotches of the back. The larger of the lateral lozenge-shaped spots sometimes alternate with the lateral extensions of the dorsal blotches,—being sometimes situated in the midst of the yellow lateral interspaces. Ground colour of ventral plates yellow, marked, in irregular alternation, with square-shaped black spots, which generally go in pairs, or alternately 1 and 2, and sometimes singly, with alternate yellow interspaces.

Teeth very small, apparently 22, in upper maxillary: 5th tooth, on each side bifid:—hindmost tooth broad, short and thick, or tubercular. There appear to be (as far as I can see) either 14, or 16 teeth in the lower maxillary: hindmost tooth longer than the others, sharp and recurved: second hind tooth also sharp and recurved.

While at Allahabad, the year before last, I bought four living snakes from a snake-catcher, which I think I might find reason to class in my new Genus *Feranioides*,—if not actually identical as to species with the individual above described.

In colouring, they somewhat resembled certain snakes which I remember seeing in the Calcutta Museum collection, named by Blyth "*Pythonella*," and by Günther "*Homalopsis*," the *Homalopsidae* being the family to which the Genus *Ferania* and *Feranioides* belong.

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PART II.—PHYSICAL SCIENCE.

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No. IV.—1869.  
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*Contribution towards the knowledge of Indian Arachnoidea ;*  
by F. STOLICZKA, Esq., Ph. D., F. G. S. &c.

(With plates XVIII—XX.)

[Received 7th April, read 5th May, 1869.]

With the exception of the CÆLENTERATA, and probably the CRUSTACEA, few other branches of Indian Zoology have received so little attention as the ARACHNOIDEA. It is really surprising to see, how very few species of Indian Arachnoids there are recorded in the leading works on the subject by Walkenaer (Aptères) and Koch (Die Arachniden &c.), when compared with the great number from other foreign countries, which one would suppose to be in this respect much less known than India. Walkenaer's descriptions of the Indian new species are, besides, often insufficient, to be of much use ; they are generally too short for the purpose of specific identification. A good number of Ceylon and some Indian ARACHNOIDEA have been, however, carefully described by Koch. Those of the Indian Dutch possessions were, to a large extent, worked out by Dr. Doleschall, and the Mauritius and Madagascar species have been monographed by Vinson. Several additions to this fauna were also lately made by Count Keyserling, Blackwall, and others.

One of the most important works for the study of Indian Arachnoidea is Savigny's excellent figures in the "Descript. Scient. de l' Egypte," although his number of new species will have to be greatly reduced, if Walkenaer's identifications prove to be correct. With the very wide geographical range, which many species of spiders are known to possess, I expect Western India will have a great number of identical species with Arabia and Egypt, the Southern portions of the Peninsula with Ceylon and partially also with Mauritius, the Southern Burmese and Malacca country with the Philippine and other islands of the Indian Archipelago. There are undoubtedly some Western Indian species the same as the Arabian, and probably European, but I have as yet so very few materials from that part of the country, that I abstain at present from quoting specific names; a list of them will be given in due time. Of the Arachnoid fauna of Bengal and the North Eastern provinces we scarcely know anything, for only very few species appear to have as yet found access into European collections. I may here remark that the distinction of the faunas which have been pointed out in the vertebrate animals between Western and Eastern India,—the one with an admixture of African, the other with that of Malayan types,—appears to be fully confirmed through the study of the ARACHNOIDEA. It is really remarkable that in examining a collection of spiders from our Eastern frontier, together with another made in Western India, often scarcely a single species will be found to be identical to both parts. Bengal has a strong admixture of Malayan types, and several species are common to it and Assam and Burma. The Western Hymalaya mountains possess in the Arachnoid fauna a prominently European character, as their general climate would lead us to expect, the Eastern Hymalaya probably contain some Chinese or Malayan types, but of this we know exceedingly little.

It is strange that not only dislike, but a real enmity and ill-feeling against Arachnoids, seems to have taken hold of men's minds. "Unheeded, or regarded with repulsive loathing by the '*cui bono*' people of the present generation" says an able writer\* who *did* observe many a magnificent tropical Arachnoid! No doubt, the few species which secrete a poisonous fluid in special glands, and through

\* Dr. A. Adams, in Ann. and Mag. Nat. Hist., 1847, XX, p. 289.

its use occasionally become dangerous, are the source of all this ill-feeling which has been extended to the most useful animals. Harmless they are certainly on the whole, and as regards usefulness scarcely surpassed by any other class of animals. They wholly live on insects and destroy a very large number of those which often create great damage to either animal and vegetable life. Thus they are important agents in sustaining a proper balance in the economy of nature, and their usefulness actually increases, by their not being dangerous in such a way, as insects often are.

These are, however, not the only reasons which entitle the ARACHNOIDEA to a fair share of attention on the part of every observer of nature. Their instinct is often higher developed, than we find it in insects. This instinct not only shews itself in the way in which they obtain their living, but also in the art of weaving in which they may be said to have been the teachers of man. Actually almost their whole life is nothing but a carrying out of clever arrangements, resulting from a certain amount of thought and deliberation. The beauties of colour, the curiosities of form, &c. which they exhibit, are equally remarkable and interesting. It is, therefore, only natural that some of our oldest classic writers have expressed their admiration of the works and the talent, exhibited by Arachnoids, in the most inspiring language, and many a beautiful idea in the mythology of the Greeks and Romans is interwoven with their manners and their mode of life.

It is unnecessary for me to go here into those historical and other accounts, to excite interest and attention to the study of the Arachnoids,—they speak for themselves. At the same time, I believe, I am justified in saying that there are very few branches of zoology, which would reward the zeal of the student with greater success, as regards new forms of animals, than the Arachnoids. Almost everything that we see and observe about us is a novelty to science; for if it is not actually so as to mere form, it is pretty certain to be so as to the real value in the study of geographical distribution, &c.

Several years elapsed since that I began to collect materials for a Monograph of the Indian SCORPIONIDÆ, having in view to initiate the study of the Arachnoids in this country by the description of a group, the animals of which are more generally and better known than common spiders. I found, however, that it would be probably many

years, before I should be able to go on with this work ; but meanwhile I have collected a large number of species from various orders of the class, and out of these I have on this occasion selected a few characteristic species of each family. I have only omitted the aquatic (PYCNOGONIDÆ and COLOPODA) and the parasitic forms (ACARINA). They are too minute to be observed with ease, though of the ACARINA some such species, for instance as those which in very large quantities destroy the leaves of the tea plant, will be worthy of examination. Of the other orders, the PEDIPALPI, (including PSEUDOSCORPIONES) SOLIFUGÆ, PHALANGIDEA and ARANEIDEA, I shall of each describe one or more species. One of the chief objects of this selection of various species, of all of which illustrations\* are here given is, as I said, to attract the attention and at the same time also to facilitate the study of the Indian ARACHNOIDEA. I hope that, with the assistance of friends, who will collect those species which they find in their neighbourhood, we may obtain the materials for a work which may form a parallel to that magnificent publication of the Ray Society, "the English spiders" by Mr. Blackwall. The Indian Museum is a safe custody for all these objects, and I shall have already to mention in the present paper a few species, for which I am indebted to Dr. J. Anderson, the Curator of the Indian Museum ; they are species collected by Messrs. Peel, Gregory and Haughton in Assam and adjoining districts. Central India is also very rich and will, I hope, furnish many species of spiders and scorpions.

#### *Order*, PEDIPALPI.

This order includes those ARACHNOIDEA in which the palpi are prolonged, often strongly thickened, and terminating with moveable claws or cheliceres. The scorpions may be called the typical forms of the order. One of the most important recent essays on the classification of *Pedipalpi* is by Dr. Peters, printed in the *Monathsberichte* of the Berlin Academy for 1861.

#### TELYPHONUS, *Latr.*

The *Telyphoni* externally very much resemble the scorpions, but they have, in place of a segmented tail with a sting at end, a simple

\* The measurements are always given in millimeters, so as to avoid differences which may result from the use of a geographical and an English inch.

multi-articulated seta, and are therefore harmless. They also have the feet much longer than the palpi, while in the scorpions the contrary is the case. Lucas published, 1835, a monograph of the genus in Guerins "Magasin de Zoologie," which is simply copied by Gervais in Walkenaer's "Aptères," vol. iii. Koch "Die Arachniden" &c. vol. x, and other authors, have since described several other species. The North American SCORPIONIDÆ have been monographed in 1863 by Mr. Wood (see Journ. Acad. Nat. Sc., Phil., 2nd ser., vol. ii, p. 358).

The species of *Telyphoni* are all remarkably like each other, and it is very difficult to find any striking distinctions between them. In habits they are quite similar to the scorpions, living in damp places under stones &c.; not unusually they are met with in houses.

**Telyphonus Assamensis, Stol. Pl. XIX, Fig. 1.**

Body depressed, all over finely granulated; general colour above dark brown, blackish on the thorax and palpi, paler on the abdomen and feet; below, the same parts respectively still paler and more distinctly reddish.

The thorax is much longer than broad, surrounded with a thin, raised margin; its front part is sub-triangular, somewhat higher than the rest. The anterior angle, near which the two central eyes are situated is obtuse; the central eyes themselves are slightly prominent and separated from each other by a round smooth tubercle. The region of the lateral eyes is also slightly prominent, two eyes, of which the lower is much the larger, being contiguous, and situated on the front side of the prominence, while the third is the smallest and somewhat more distant. The posterior part of the thorax which is nearly double as long as the anterior has, on the surface, numerous depressions of which a central longitudinal groove is the most conspicuous.

The palpi are about as long as the abdomen, they are very stout. The first moveable segment has 4 spines on the upper inner edge, the last two have a common base and the outer one is the stronger; the upper anterior edge has only one spine, and the lower two subequal ones on a common base. The second segment which is very obliquely articulated to the first has one small spine on the lower front edge; the third has anteriorly one inner long process, and the fourth a smaller internal one, but a much larger external, articulated and slightly curved.

The maxillæ are very short, pointed, horizontal. The feet of the first pair are the thinnest and longest, the metatarsi, [or should these be considered as the tibiæ?] are one long segment, the tarsi are made up of 8 short points and terminate without claws. The other feet are much more robust, the fourth is longer than the third and the third longer than the second, the last two being sub-equal. Each of the feet has only a very short thick metatarsus, and the tarsi consist of four joints, the last of which terminates with two strong claws; on the fourth pair of feet there is usually a fifth segment well defined.

Below, the front part is occupied by the immoveable base or the basal segment of the palpi which forms a broad triangle, separated longitudinally by a groove next to which in front there is a very strong slightly curved spine. The coxæ of the three last pair of feet, (the first being articulated much higher) are broad, almost contiguous, leaving behind the last only a small triangle as the rudiment of the sternum.

The abdomen is much elongated with sub-parallel sides; it consists of a minute first and 8 other larger segments, each of which has about the centre a pair of rounded depressions. Below, the first segment is the longest and the two subsequent ones, are very short; in the centre of the first the sexual opening is situated.

The seta is very slender, longer than the abdomen, attenuated towards the end, and consists of from 35 to 40 short segments, gradually becoming smaller toward, the tip; occasionally some of the middle ones are a little longer than others. The base of the seta is formed of three segments, the last being the longest and cylindrical, the two previous more flattened and very short.

The size of this species varies very much. Young specimens are often found scarcely half an inch long, and others more fully grown which exceed two inches; the last are the largest I have observed; the former also differ in colour, being usually more reddish brown, while older ones are dark or blackish brown.

\*Length of the thorax 16·4 m.m.; its width about the middle 10 m.m.

————— abdomen 22 m.m.; ————— 11 m.m.

\* The nomenclature of the different parts of the body will be fully understood by a reference to the explanation accompanying the plates.

|                                                   |                                      |           |     |
|---------------------------------------------------|--------------------------------------|-----------|-----|
| Length of the abdominal seta (including the base) |                                      | 31.5 m.m. |     |
| „                                                 | of the cheliceres, .....             | 29.0      | „ „ |
| „                                                 | of one foot of the first pair, ..... | 57.0      | „ „ |
| —————                                             | 2nd ———                              | 30.5      | „ „ |
| —————                                             | 3rd ———                              | 34.0      | „ „ |
| —————                                             | 4th ———                              | 46.0      | „ „ |

What distinguishes the present species in particular are the various depressions on the thorax, the entirely vertical position of the posterior lateral eyes, the thin raised margin which surrounds the thorax and abdomen, and the long seta with very numerous small segments. *Telyph. spinimanus*, Lucas, of unknown habitat, is very closely allied to our species, but the feet and palpi are in proportion to those of ours shorter, and the tarsi of the first pair of feet not so numerous. Another still more closely allied species is described by Mr. H. C. Wood from China as *Telyph. Stimpsonii* (Proc. Acad. Nat. Sci., Phil., 1861, p. 312); however the palpi, or cheliceres, of this species are described as somewhat different, the denticulation of the first moveable segment being very similar, but the third is larger than the others, which is not exactly the case in our species. The third segment has in *T. Stimpsonii* two minute spines above and the terminal internal process is bifid, and the processes of the fourth point are strongly serrated, while in the Assam species the process is not divided, and the upper spines on the third, as well as the strong serration of the fourth are absent.

Loc. Assam. A large number of specimens of this species has been sent by Messrs. Peel, Haughton and Gregory. These specimens vary in size from half an inch to two inches, but they evidently are only different stages of age of one and the same species. The young specimens are sometimes of a quite uniform reddish brown colour and have comparatively a longer tail than the old ones, while the spines on the second (externally the 1st) segment of the palpi are not perfectly developed. The species lives in damp places under stones, and is also often met with in bath-rooms of houses, in company with true scorpions. My colleague Mr. V. Ball informs me that he also procured a species of a *Telyphonus* in Western Bengal, it may be the same as the present, but more likely another species which Koch describes from the East Indies. Several specimens of this species also exist in the old collection of the Asiatic Society, but no record of localities exists.

## Order, SOLIFUGÆ.

## Family, GALEODIDÆ.

The animals, forming this division of the *Arachnoidea*, have the general form of true spiders, the abdomen being distinct from the thorax, it is, however, distinctly annulated and not provided at its end with any kind of spinners; the palpi are of a somewhat similar form and length, as the feet. The peculiarity of the abdomen and the palpi has caused the separation of this single family of the GALEODIDÆ into a separate order. The animals are, besides, characterised by the horizontal form of the falces, terminating with an upper fixed and a lower immoveable claw; they only have two eyes, like the *Phalangia*, placed on a common tubercle on the thorax; all of them also appear to have a number of wing-like appendages on the lower side of the anterior portion of the last pair of feet; the physiological functions of these appendages is however, I believe, still unknown; they only live in warm climates.

Koch published a monograph of the family in vol. viii of the "Archiv für Naturgeschichte" 1842, p. 350. The author suggests a division, according to the number of segments of the tarsi, in *Solpuga*, Lichtenstein, *Galeodes*, Olivier, *Aellopus*, Koch, *Rhax*, Hermann and *Gluvia*, Koch. A few additional species are recorded by Gervais in Walkenaer's "Aptères," vol. iii, p. 90, but very few other species appear to have been described since. The Indian species mostly seem to belong to the genus

## GALEODES, Oliv.

These have the tarsi of the 2nd and 3rd pair of feet with 2, and those of the 4th with 3 segments. There have been, I think, three species named from India. The most common, said to have been already known to Aristoteles, is the Bengal species *Gal. fatalis*, Herbst. (Ungeflügelte Jns. p. 32, pl. I, fig. 1), which has the cephalothorax nearly triangular, considerably depressed and channeled in front, the appendages of the fourth feet nearly sessile, and these last more hairy than the others. A second species was named by Gervais, *G. brevipes*, and is said to be from Nepaul (Walkenaer, Aptères, vol. iii, p. 87). It is stated to have a short and stout body, a thin lamina in front of the head (cephalothorax) which is nearly

smooth and brownish, the abdomen elongated oval, the feet short and pale reddish, the tarsi brown, and the falces strongly denticulated, blackish. With neither of the species can the one here described from Western Bengal be identified, but a fourth species, apparently, from Central and Northern India, was named by Capt. Hutton, *Gal. (vorax?)* (see Journal Asiatic Society Beng., vol. xi, pt. II, 1842, p. 857). Capt. Hutton gives there a very full and interesting account of the habits and manners of a large species of *Galeodes*. It is said to occur in Northern India, the Punjab and Afghanistan. The usual size is  $2\frac{1}{2}$ — $2\frac{3}{4}$  inch., and the abdomen is equal to a thrush's egg. Capt. Hutton's description is in other respects so general, that it would be impossible to identify any species with it; I can only say that neither the form nor the size of the body of the new species, here described, appear to coincide with the account given of *G. (vorax?)*, while the common Indian species, *Gal. fatalis*, is often said to reach the same size as the last, and I rather think it doubtful if they are distinct species.

The *Galeodes* appear to be common all over India, but especially in the South. Mr. H. F. Blanford tells me that he observed them in large numbers and of great size in the Trichinopoly and Arcot districts. It would be especially interesting to observe these, and also those occurring in Western India, and to compare them with the Persian, Arabian, and Egyptain species, from which countries many are known.

### **Galeodes orientalis, Stol. Pl. XVIII, Figs. 4—5.**

♀. General colour above yellowish brown; the terminations of the falces dark brown; eyes black; abdomen blackish grey, pale at the sides; feet yellowish, brown in the middle; the last ante-terminal segments of the palpi brown; below, uniform whitish or yellowish.

The cephalothorax is sub-quadrangular, broader in front than behind, the anterior part is considerably higher than the posterior, sloping in front towards a sharpened, dark brown edge, deeply indented just before the projecting corners; along the whole of the posterior (and partially lateral) edge there is a very deep groove present; the surface is finely granular, and like the median segments covered with longish hairs, those of the abdomen being, however, much more numerous and

shorter than others. The falces are a little longer than the thorax, the two segments being strongly inflated, thickly set with moderately long stiff hairs; and two dark brown longitudinal stripes on the upper side of each are distinct. Their claws are attenuated, slightly incurved; the upper is finely serrated inside, the lower moveable joint being the stronger one; they are unequal, the left pair of the falces being distinctly longer than the right one, and each of them has, above near the claws, one long horny appendage, something of the form of a plume. The palpi are much longer than the entire body from the tip of the falces to the anus, they are very stout; the last or terminal joint is the shortest, inflated at the end, internally supplied with a brownish lamina, which has on the inner side a circular rather prominent field, and next to it on the outer side are two small tubercles, one below the other.

The three segments forming the thorax are distinctly separated and become gradually smaller towards the abdomen; the last pair of feet is by far the longest, then come the third and the first which are nearly of the same size, each of them being about equal to the length of the whole body. The first pair is without claws, the other pairs each possess two slender claws. All the feet are covered with numerous long and very thin hairs, unequal in size; on the first pair and on the palpi some of them are particularly elongated.

The abdomen is elliptical, composed of 9 segments, thickly covered with short hairs, equally narrow in front and behind, where it is slightly raised; in fresh specimens it is somewhat inflated, but in dried ones it becomes more flattened; the ventral side, at the beginning of which the stigmata and the genital opening are situated, has centrally a deep longitudinal groove; the anus is terminal, situated in an almost perpendicular slit; the abdomen is, as stated before, blackish grey above, yellowish on the sides and below.

♂. The male is perfectly similar to the female in form and colouration, but very much smaller; it has the left falces also a little longer than the right ones, and both with similar plume-like appendages; the palpi appear to be in proportion a little longer than they are in the female, (though not so well expressed in the figure, the body having been made a little too long); the penultimate segment is dark brown, the last one has at the end a white skin, slightly emarginated and folded at the terminal edge.

|                                                 | ♀        | ♂       |
|-------------------------------------------------|----------|---------|
| Length of the cephalothorax, .....              | 6 m.m.   | 4 m.m.  |
| Width in front, .....                           | 7 „ „    | 4.5 „ „ |
| Length of the three thoracic segments, ...      | 5 „ „    | 3.5 „ „ |
| Length of the abdomen, .....                    | 12 „ „   | 8.5 „ „ |
| Width „ „ „ in the middle,.....                 | 8 „ „    | 5 „ „   |
| Length of the palpi, ... ..                     | 43 „ „   | 30 „ „  |
| Length of one of the first pair of feet, 33 „ „ | 18.5 „ „ |         |
| ————— 2nd .....                                 | 27 „ „   | 17 „ „  |
| ————— 3rd .....                                 | 32 „ „   | 23 „ „  |
| ————— 4th .....                                 | 50 „ „   | 33 „ „  |

This species most closely resembles the one figured by Savigny (in the Exped. de l'Egypt, &c.) as *G. arenoides*. Koch (Archiv für Naturgeschichte, viii, 1842, p. 353) considers it distinct from the European *G. arenoides* of Pallas, and names it *G. Arabs*. This species is, according to Koch, pale yellowish, with two brown stripes on the falces, two large spots on the cephalothorax, and a longitudinal stripe on the body. The present species differs from it by the want of any spots on the cephalothorax and by having in both sexes the palpi much longer in proportion to the body.

Loc. The two figured specimens were obtained by Mr. T. H. Hughes in the Birbhúm district of Western Bengal; I have also obtained lately some specimens from the neighbourhood of Delhi through Mr. R. Mitchell; the species appears to be common there.

### Order, PHALANGIDEA.

#### Family, PHALANGIDÆ.

The PHALANGIDÆ belong to a small division of *Arachnoidea*, which have the cephalothorax not distinctly separated from the abdomen, but, in other respects, greatly approach true spiders; they have the feet usually very long and slender in proportion to the body, and the thorax bears on a prominence two large eyes; in some species two other small accessory eyes are said to exist; the falces consist of two segments the second of which is didactylous at the end, possessing a moveable short claw.

The vitality of the feet of the *Phalangia* has been often noticed, and I would call the attention of any one interested in the subject to

a very interesting paper of Mr. Lindemann in the Bull. Soc. Moscou vol. xxxvii, pt. II, (p. 537). The author describes here the muscular system with some detail, and points out how the *Phalangia* use their two alternate pairs of feet when moving about. The paper is important because this mode of muscular actions as well applies to the largest number of other *Arachnoidea*.

Koch in his "Uebersicht des Arachnidensystems," Nürnberg, 1839, pt. II, referred the GALEODIDÆ and PHALANGIDÆ to the order SOLIFUGÆ, and the genera allied to the PHALANGIDÆ he separated into 5 families TROGULIDÆ, SIRONIDÆ, GONYLEPTIDÆ, COSMETIDÆ and OPILIONIDÆ, the last named being equivalent to the present family PHALANGIDÆ, which have the last pair of feet similar to the others, the cheliceres or palpi without spines, &c.

The distinction of genera in this family is now principally based upon the form of the thorax and the spines surrounding the eyes. Strictly speaking they are to a great extent merely convenient sections, for those characters pass so gradually one into the other, that a strict generic definition, in the manner proposed by Koch, is quite impossible. Koch's previous divisions of 12 genera is on the contrary based upon the number of tarsal segments, and seems in some respects preferable; but it is scarcely necessary to say that no single characters alone ought to be taken as leading in such cases.

The English species of this family were monographed by Mr. R. H. Meade (Ann. Mag. Nat. Hist., 1855, vol. xv, p. 393, with additions in vol. vii, 1861, of the same Annals). Koch (Arachniden, vols. ii and viii) described a large number of European and foreign species, but only very few Asiatic, and hardly any Indian ones.

#### GAGRELLA, *Nov. gen.*

Koch has proposed the genus *LEIOBUNUM* to include those species which have the edges of the eyes smooth, no processes on the palpi and a short body with very long legs. To some other, apparently Asiatic species with one horn on the abdomen and 25 segments of the 1st, 3rd and 4th pair of feet, Koch gave (Arachniden vol. xvi) the name *Acanthonotus*, (see Koch's Uebers. d. Arach., pt. II, 1839), but this name has already been applied in 1835 by Owen to an Amphipoden Crustacean. It seems to me, however, that there is sufficient ground for a new generic separation of the species with a spiny abdomen from *Leibunum*, for in

this genus the segments of the body are distinctly traceable above, while in *Gagrella* the upper surface is almost uniformly coriaceous, only the terminal portion consisting of distinct segments. As regards the position of the eyes with their smooth margins, and also as regards the form of the palpi, falces, feet, &c., both genera are much alike. In *Gagrella* the metatarsal and tarsal segments are very numerous, differing with the length of the feet; the former vary from 5-8 on the 1st and 3rd pair of feet, and from 7-15 on the 2nd and 4th pair, the latter vary from 20-30 on the 1st and 3rd and from 30 to about 100 on the others; all the joints of the tarsi become very gradually shorter towards their terminations, and each of the tarsal and metatarsal parts is provided at its end with a minute spine. Herbst described from the East Indies a brown *Phalangium monocanthum* which has the thorax posteriorly truncated. Koch described from Bombay an *Acanthonotus niger* (Arach. xvi, p. 61, p. 159, p. 1541) which also differs from the next species in the form of the body.

**Gagrella atrata**, Stoll. Pl. XVIII, Fig. 2, Pl. XX, Fig. 11.\*

The whole body is finely granular, above entirely black, below ashy or brownish; the falces or cheliceres, the two terminal segments of the palpi, the anterior small portions of the femora and the tarsi yellowish or pale brown, the rest of the feet, &c. blackish brown.

The cephalothorax is somewhat semilunar, convex, in front provided with two short spines, at the lateral edges emarginated opposite each coxa; posteriorly it is concave, with a double raised margin; the tubercle, bearing the eyes laterally, is situated somewhat below the middle: it is narrow at the base and furrowed along the middle. In front and at the sides of the ocular tubercle there are, besides, some indistinct depressions on the surface of the thorax observable.

The falces are thin, equal to about two-thirds of the length of the palpi, with the terminal claws brown. The palpi are also slender and a little shorter than the body, terminating with a single strong claw.—The lip is very small, the so-called maxillæ rather long, and in common with the projecting bases of the palpi provided with short soft papillæ. The sternum is long, broader posteriorly, slightly concave at the sides and with the front edge, under which the sexual opening is situated, somewhat raised. The coxæ are long, depressed,

\* This represents a more common variety with a shorter body, than the one shewn in Fig. 2, Pl. XVIII.

with serrated edges; the feet are long and slender, the second is the longest, a little more than ten times as long as the body, then come the 4th, 3rd, and 1st, the last two being subequal, and a little more than half the length of the first. The single claws are distinct only on the two last pairs of feet. The abdomen is about one-third longer than the thorax, with subparallel sides, and very obtusely pointed posteriorly; the surface is slightly convex, coriaceous, with the segments,—except the last three which are situated low down,—very indistinctly marked; a little before the centre it has a solid almost perpendicular spine. On the lower side there are only five segments very distinctly marked; below the base of the sternum there is on each side a small trachean opening.

|                                   |               |           |             |
|-----------------------------------|---------------|-----------|-------------|
| Length of the thorax              | 2-2½ m.m.;    | its width | 4.5—5 m.m., |
| ————— abdomen                     | 4.7—5.3 m.m.; | —————     | 4.5—5 „ „   |
| ————— one foot of the first pair, | .....         | 22        | m.m.        |
| ————— 2nd                         | —————         | 37        | „ „         |
| ————— 3rd                         | —————         | 20        | „ „         |
| ————— 4th                         | —————         | 32        | „ „         |

Loc. Neighbourhood of Calcutta; I obtained a few specimens in an old native hut, and some others among old branches of wood. The animals are very quick in their movements.

### **Gagrella signata, Stol. Pl. XX, Fig. 10.**

The entire body is finely granular, a yellow line begins at the front end of the thorax, divides just before the ocular tubercle, each branch becoming widened and extending along the lateral margins of the abdomen posteriorly; the middle part of the abdomen is purely black, the rest of the thorax and the feet brown with the joints darker, the palpi and falces on the lower surface rather pale, the sternum and abdomen partially ashy.

This species which in general form resembles the former, differs considerably in colouring. The body is rather short, or broadly oval; the cephalothorax has no spines in front, it has, however, a double ridge posteriorly, but the margin is moderately concave. The abdomen has one high and nearly perpendicular spine placed before the centre. The under surface is also quite similar to that of the last species, the coxæ being flattened and serrated on the edges &c., (see fig. 10 a). The most

important distinction consists in the length of the feet ; those of the second pair being the longest, nearly 18 times longer than the body, the tarsi are equal in length to the each preceding segment respectively ; the first pair of feet is scarcely longer than one half of the second, and is the strongest ; the 4th comes next to the second but is much shorter, while the 3rd is only little shorter than the first.

Length of the thorax 2.7 m.m. ; its width posteriorly 6 m.m.

————— abdomen 5.2 m.m. ; ————— 5.5 „ „

—————one of the first pair of feet ..... 50 m. m.

————— 2nd ————— ..... 95 „ „

————— 3rd ————— ..... 41 „ „

————— 4th ————— ..... 63 „ „

Loc. This species was sent by Mr. Peel to the Indian Museum, from Sibsaugur in Assam ; it appears to be very rare ; I have not observed it anywhere about Calcutta.

Order, ARANACEA.

Family, LINYPHIIDÆ.

HERSILIA, *Savigny*.

This genus was established for a species, *H. caudata*, from Egypt, collected during Napoleon's expedition to that country. Lucas published in 1836 in Guérin's "Magasin de Zoologie" some valuable notes on the genus, pointing out its peculiarities as regards the position of the eyes, the great length of the slender feet and that of the two posterior appendages of the spinners. Lucas also described two species from the Malabar coast, *H. indica* and *Savignyi*, but Walkenaer (Aptères, I, p. 372,) considers the latter to be a young specimen of the former, though (l. cit., vol. iii, p. 433) he again does not seem to be certain of his former suggestion. The same author separates here *Hersilia* into two groups which he calls "Heteropodes" and "Orthopodes," in the former the third pair of feet being very short, in the latter subequal to the others. The species which I shall here describe belongs to the former group ; it is quite distinct from either of the two forms noticed by Lucas, but it is rather similar to a species described by Blackwall from one of the Cape de Verde Islands (St. Jago) ; I shall, however, point out the distinction of both (see Ann. and Mag. Nat. Hist., 1863, 3rd ser., vol. xvi, p. 80).

It is difficult to find an appropriate position for the genus, but from the general appearance of the body and the distribution of the eyes, it seems to me that *Hersilia* has a great relation to *Linyphia*. Its habits are, however, very similar to those of *Philodromus*, and the same is the case as regards the proportionate length of the feet; it may, therefore, be also correctly placed near, or in, the family THOMISIDÆ.

There are several species found all through India, Burma and the Malacca straits. I have observed them mostly on palm-trees, the bark of which they much resemble in colouring; they are sometimes also called mango spiders.

### ***Hersilia Calcuttensis*, Stoll. Pl. XX., Fig. 9.**

♀. Cephalothorax scarcely broader than long, the ocular region narrow and strongly elevated, the posterior region with the lateral margins strongly curved, with one longitudinal central and two transverse fine grooves; the anterior part is the smaller. The grooves and the margins are partially dark brownish, the rest is yellowish, thickly covered with short white hairs.

The eyes are in exactly the same position as in the type species; the two anterior on each side form with the posterior laterals an ascending triangle, and the anterior laterals are very small, situated in front and below the posterior laterals; of all the eyes the anterior centrals are the largest. The immediate region round each eye is dark brown.

The falcæ are shorter than the sternum, sub-cylindrical, at the base rather contracted, pale brown with moderate dark brown claws.

The lip is broadly semicircular, short; the maxillæ somewhat higher, thick at the base, attenuated towards their ends and strongly converging. The palpi are thin, more than double the length of the falcæ; they are yellowish with black tips; the lip and maxillæ are a little darker than the other organs.

The sternum is almost broader than long, flat, greyish brown, thickly set with hairs, anteriorly emarginated, posteriorly obtuse. The feet are slender and very long, the first being the longest, then the second, which is only a little shorter than the fourth, and then comes the third which is about equal to one-half of one of the second pair. The colour is pale yellowish with dark terminations to the joint. No bands are traceable.

The abdomen is oval, posteriorly broader and more inflated, obtusely pointed at the extreme end; the anterior edge slightly covers the thorax. The general colour is a fawn or pale brown, with very numerous equally distributed white dots; a dark brown band extends from the anterior edge to about the middle of the abdomen, or more than half of its length, and at the end it is provided with short processes. Laterally, from the anterior edge, a thin zigzag brownish stripe with one blackish dot at each angle runs to the anus. The lower side is of a uniform greyish fawn colour, and thickly covered with whitish hairs. The epiginium is slightly prominent, brownish, with a thickened white posterior margin. The outer appendages of the spinners equal in length to the body; they consist of three joints, the first being very small, the second about three times as long as the former and the third somewhat more than three times as long as the second, gradually attenuating into a point. The middle pairs of spinners extend only to half the length of the second joint.

Length of thorax . . . . 3 m.m.; its width in the middle 3 m.m.

———— abdomen 6 „ „ ; ————— 4.5 „ „

———— of one foot of the first pair, ... 22 m.m.

———— 2nd ——— ... 20.5 „ „

———— 3rd ——— ... 8.5-9 „ „

———— 4th ——— ... 19 „ „

From Blackwall's *H. versicolor* this species differs by having the second pair of feet almost quite as long as the first, by the want of whitish bands on the feet and the different markings of the thorax and abdomen, the latter possessing a number of dark spots extending from the posterior end of the dark longitudinal band to the spinners.

Loc. Neighbourhood of Calcutta; apparently very rare, only one full grown specimen having been met with during a period of two years collecting of *Arachnoidea* in this vicinity; it was caught on the wall of a house. I subsequently observed another young specimen in my own house; it moved about either forward or sideward, flatly pressed to the wall, exactly like a *Philodromus*, and appeared to be very shy. Like the young of *Philodromus*, this young *Hersilia* was more hairy than the full grown animals are.

Family, *LYCOSIDÆ*.*DOLOMEDES*, Latreille.

The species of this genus are chiefly characterised by the arrangement of their eyes, of which the four anterior are small and in one line, while the four posterior form a trapezoid, narrower in front than behind. Some of the species have short feet and in general character resemble the *Lycosæ*, with which the disposition of the eyes mostly agrees; other species have long feet and resemble the *Philodromi* of the *THOMISIDÆ*, or the *Nephilæ* of the *EPEIRIDÆ*. I rather think that a few good generic, or subgeneric, types will have to be distinguished among the forms now referred to *Dolomedes*, but my present very scanty materials do not permit me to enter into the details of this question. I shall note only one species which appears to be particularly interesting.

*Dolomedes longimanus*, *Stol.* Pl. XX, Fig. 3.

♀. The cephalothorax is large, more than half the length of the abdomen, roundish oval, slightly convex, narrowly truncated, and sloping in front and behind; yellowish brown with dark brown margins, and a pair of rather broad longitudinal bands of the same colour in the middle.

The cephalic region is very little elevated, and not distinctly separated from the posterior, which has a short groove in the centre. The four small anterior eyes are on the front side, they are grouped in two pairs though not well defined; the four posterior, much larger eyes form, as usually, a trapezoid, the anteriors being the smaller ones, and placed nearer to each other than the posteriors.

The falces are cylindrical, little shorter than the sternum; with small claws; they are yellowish with a longitudinal broad streak of a brown colour.

The lip is subquadrate, broader than long, sub-truncate in front; the maxillæ are longer than broad, about double the length of the lip, very little broader at their terminations; the palpi are inserted at their upper bases, they are thin, the 2nd segment being the longest, and next comes the 5th; all these organs are pale yellowish, covered like the rest of the body with short hairs, only a few of them being blackish.

The sternum is oval, truncate in front, obtusely pointed behind, hairy,

yellowish with a brown, partially interrupted streak near the margin, opposite the thickened coxæ of each of the three first pair of feet. All these are remarkably slender, and as regards proportioned length rather different from those usually met with in other species of *Dolomedes*. The first pair is by far the longest, the 2nd and 4th are subequal, and the third is a little longer than one half of the 4th.

The abdomen is sub-cylindrical, about half as long again as the thorax, but narrow, truncate, and slightly covering the base of the former with its anterior edge which is provided with a number of stiff short hairs. The centre is occupied by a brown streak attenuating posteriorly into a point; the remaining portion of the upper surface has also a brownish tinge but there are numerous greenish white shining dots on it; the sides possess a few darker oblique transverse blotches and are bounded above by an undulating whitish margin; below, the surface is pale yellowish brown with two narrow, whitish, somewhat raised lines, beginning at the sexual opening and converging towards the spinners which are terminal.

Length of cephalothorax 4 m.m.; its width in the middle 4 m.m.

|                                |    |      |   |     |
|--------------------------------|----|------|---|-----|
| abdomen .....                  | 7  | „ „  | 3 | „ „ |
| one foot of the 1st pair ..... | 35 | m.m. |   |     |
| 2nd — .....                    | 25 | „ „  |   |     |
| 3rd — .....                    | 15 | „ „  |   |     |
| 4th — .....                    | 28 | „ „  |   |     |

This is a very peculiar species of *Dolomedes*; it entirely agrees with this genus in the disposition of the eyes, the general form of the body, the length of the falces, the form of the lip and maxillæ &c., all characters upon which genera of Arachnoids are almost solely based; but the feet are those of a *Nephila*, very slender, the first pair being the longest, while in *Dolomedes* the fourth is usually the longest, or at least sub-equal to the first. The shortness of the feet of the 3rd pair is also remarkable, but as there are several species of *Dolomedes* known with equally long feet, I rather prefer placing the species in this genus than proposing a new one, especially as I am at present only in possession of a single specimen.

Loc. Neighbourhood of Calcutta, apparently a very rare form; I obtained it a few years ago in the botanic garden on the leaf of a tree, but never met again with a second specimen.

Family *SALTICIDÆ*.*SPHASUS*, Walck.

Blackwall classifies the species of this genus in the family *LYCOSIDÆ*, but the short truncate form of the cephalothorax, with the unequal eyes disposed in front of it, seems to me to indicate a much greater relation to the *SALTICIDÆ* than to the last named family. I have observed several species in various parts of India; they generally hunt after insects among grasses between which they jump about exactly like do the species of *Salticus* on walls, they sometimes also form a small loose snare; some of them defend themselves furiously when caught with the hand, and if released they drop supporting themselves by a single thread. Walckenaer in his work (*Insect. Aptères*, vol. i, p. 376), characterizes a species *S. indicus*, which was sent to him from Bengal with the following words "abdomen ferrugineux, bordé de noir; corselet et pattes ferrugineux." It is impossible to identify a species from such a description, for the colour of specimens, when not well preserved, very much changes in spirit. I have not seen any species of that colouration, and very likely the specimen from which the above description was taken, was first dried and afterwards put in spirit, in which case a reference to general colouration is as good as worthless. The green colours of the *Sphasi*, and also of the *Thomisi*, very rapidly fade away in spirit, changing to pale or greyish brown.

***Sphasus viridanus*, Stol., Pl. XX, Fig. 1.**

♀ Cephalothorax oval with the cephalic part high, convex, narrower anteriorly than posteriorly; the thoracic part is much broader, with convex sides and with a deep groove in the middle, in continuation of the two grooves which separate it from the former; both parts are uniform pale green, with two small, brown, lateral spots about the middle of the upper surface, and some other equally small dark green dots, irregularly distributed over the surface; hairs very few and short. On the front side a broadish, dark green line runs down perpendicularly from each of the first pair of eyes to the base of the falces and one similar line is seen laterally; the lower corners at the base of the falces are purplish.

The eyes are situated close together on a roundish, upper anterior protuberance of the thorax which is reddish, or rather violet brown,

and thickly covered with short, depressed, gray hairs. The two anterior eyes which are situated on the front surface are very small, those of the second pair placed near the edges of the thorax are the largest, and the posterior, arranged in a curve, are of median size.

The falces are long, pyramidal, thick at their base, becoming gradually thinner towards their ends; they are of the same green colour as the thorax which has, below and externally on each side where the falces are articulated, a small brown spot at the edge; the claws of the falces are comparatively very small and pale brown.

The lip is green, long, narrow, with an attenuated and pointed termination; it is a little shorter than the maxillæ, and these again a little shorter than the mandibles. The maxillæ are dilated at the base where the palpi are inserted on the outer side, somewhat contracted in the middle and again slightly broader at their ends, which from a pale green gradually pass into a brownish hue. The palpi are thin, provided with short black hairs.

The sternum is grass green, small, depressed, somewhat heart-shaped, being anteriorly slightly indented. The legs are pale green, with numerous scattered black hairs which, as likewise those on the sternum, originate from smaller or larger blackish tubercles; they become much longer on the tibiæ and tarsi, than they are on the femora. The first pair of feet is the longest, the second comes next, but it only slightly differs in length; then comes the fourth and at last the third, which is also only a little shorter than the fourth. The inferior central portions of the femora of the first pair are distinctly carmine red, and a slight tinge of this colour is also observable on the femora of the second pair. The ends of all the tarsi become brownish and each terminate with two short black claws.

The abdomen is pyramidal, distinctly separated from the body, mostly elevated at its anterior end, and partially covering the thorax, broadest near the middle and then very gradually tapering posteriorly to a point, on which the anal appendages slightly project. It is of a uniform yellowish or sometimes bright green colour, with some lateral stripes or corrugations posteriorly, extending over the whole breadth of the abdomen. About one-fifth distant from the anterior end is a silvery white, horse shoe shaped mark, formed of four somewhat raised

dots, and extending posteriorly on either side, until the white stripe gradually disappears; this abdominal white stripe is only seen in full grown specimens. The genital opening lies between two small, green tubercles, and the trachean opercula are large, oval, lateral, quite flat, posteriorly white margined.

Length of cephalothorax 6 m.m.; its width about the middle 4.5 m.m.

|                                     |       |                       |         |
|-------------------------------------|-------|-----------------------|---------|
| ———— abdomen.....                   | 8 „ „ | ———— anteriorly ..... | 4.0 „ „ |
| ———— one foot of the 1st pair ..... | 32    | m.m.                  |         |
| ———— 2nd ——— .....                  | 30    | „ „                   |         |
| ———— 3rd ——— .....                  | 23    | „ „                   |         |
| ———— 4th ——— .....                  | 24.6  | „ „                   |         |

This, as likewise the next species, differs from most of the European forms of *Sphasus* by the elongated narrow lip, but the pyramidal shape of the falces, the arrangement of the eyes and the whole form of the body agree with the type of the genus.

Loc. Neighbourhood of Calcutta; appears to be rare, three specimens were found while hunting after insects between the large leaves of a low shrub. The male was not observed.

### ***Sphasus similaris*, Stoll. Pl. XX, Fig. 2.**

Cephalothorax suboval, truncate in front and behind, very high, with convex sloping sides, and slightly narrower at the ocular region; yellowish, covered with very short brownish hairs which form two parallel longitudinal lines along the centre; and two other similar ones are also partially conspicuous on the sides of the thorax.

The eyes are situated on the upper anterior part of the thorax. The four posterior ones form, as usually, a curve with the convexity directed backwards; the external ones are placed laterally in front, they are more distant than those of the previous species. The two eyes of the second row are situated in front of the curve, they are rather close together and are the largest; the four posterior ones are smaller and sub-equal; a round black spot extends from each eye into the central space surrounded by them. The two anterior eyes are closer together than those of the second row and are very small. The entire region occupied by the eyes is covered with short silvery hairs. A conspicuous but very fine dark line extends from each of the small anterior eyes towards the margin of the thorax, and is continued on

the falces; there is also a minute dark spot on the external angle of the thorax where the falces articulate.

The falces are pyramidal in shape, vertical, tapering gradually towards their ends; they are greenish with a brownish tinge near the articulation of the small claws.

The maxillæ are elongated, very little broader and roundish at their terminations, somewhat shorter than the falces; the palpi are articulated at their external bases, but the maxillæ are only thicker at this place, not being dilated in front. The lip is somewhat shorter than the maxillæ, slightly wider about the middle and conspicuously contracted and produced at the end.

The sternum is rather roundish, truncated in front and somewhat pointed posteriorly; conspicuously indented at the point of articulation of each coxa. The first pair of feet is the longest, the 2nd and 4th are sometimes perfectly equal, sometimes the 2nd is a trifle longer; the 3rd pair is only little shorter, than either of the two last named ones. The sternum, lips, maxillæ and coxæ are yellowish green, the femora are purely green, and all feet are covered with very fine whitish and with larger stiff black hairs. The tibiæ and tarsi have a brownish or violet tint, and the black hairs on them are long and spiny. The terminal part of the tibiæ of the last pair of feet is almost black. Each of the femora have on the internal side two black longitudinal lines, of which the anterior one is the more conspicuous; above, there are also two or three obsolete blackish lines.

The abdomen is much elongated, thickest in front, but scarcely covering the edge of the thorax, and gradually tapering towards the oval end; it is wholly covered with very fine hairs. The front part is pure silvery white, the rest is pale brown. Two very thin conspicuous white lines, internally margined with dark brown, and forming an elongated ellipse, unite in the middle and continue as a single white central line towards the end; this posterior part of the line becomes occasionally obsolete. Three white lines originate anteriorly and partially laterally, and converge together above and posteriorly, but they do not reach the centre, and are on both sides margined with dark brown. Laterally there are very numerous short white stripes which also become obsolete towards the posterior end. Below is a longitudinal central black band, accompanied on either side by a slightly narrower silvery one.

The spinners are blackish, the genital opening on an obtuse dark brown tubercle, and the trachean opercula are large, suboval and very pale brown.

|                                   |          |                            |               |
|-----------------------------------|----------|----------------------------|---------------|
| ♀ Length of the thorax            | 4 m.m. ; | its width about the middle | 2.5 m.m.      |
| ————— abdomen                     | 7 „ „    | ————— anteriorly           | ..... 3.0 „ „ |
| ————— one of the 1st pair of feet | .....    | 15                         | m.m.          |
| ————— 2nd                         | —————    | .....                      | 14.5 „ „      |
| ————— 3rd                         | —————    | .....                      | 12 „ „        |
| ————— 4th                         | —————    | .....                      | 12.5 „ „      |

♂ The male is in colouring entirely similar to the female, but is often considerably smaller. The cephalothorax is shorter and stouter in proportion, and the abdomen thinner than in the ♀. The terminal joints of the palpes are at the base strongly inflated, in young specimens greenish or brownish, in full grown ones perfectly black, below with a large opening fitted out with soft skin and a horny laterally projecting black flagellum; the whole is surrounded with various longer and shorter, black, stiff hairs (see pl. xx, fig. 2c).

|                                              |          |                            |               |
|----------------------------------------------|----------|----------------------------|---------------|
| Length of the thorax ..                      | 3 m.m. ; | its width about the middle | 2.5 m.m.      |
| ————— abdomen                                | 6 „ „    | ————— anteriorly           | ..... 2.5 „ „ |
| Length of one of the 1st pair of feet, ..... | 13       | m.m.                       |               |
| ————— 2nd                                    | —————    | .....                      | 12.5 „ „      |
| ————— 3rd                                    | —————    | .....                      | 10.5 „ „      |
| ————— 4th                                    | —————    | .....                      | 11 „ „        |

For some time I regarded this species as identical with *Sphasus lepidus*, Blackw. (Ann. Mag. Nat. Hist. 1864, 3rd ser., vol. xiv, p. 36), but judging from that author's description, it must be considered as distinct, differing by the markings of the cephalothorax and of the abdomen, by the elongated form of the lip, etc.

Loc. Neighbourhood of Calcutta, very common (in April and May) among grasses, hunting after insects etc.; it occasionally makes a very loose snare.

#### Family, THOMISIDÆ.

I hardly think a distinction necessary between *Thomisus* and *Xysticus* in the manner as proposed by Koch, and accepted by several arachnologists. The unequal size of the eyes is in no way associated with the greater length of the 3rd pair of feet, as pointed out by Prasch (see

Zool. Bot. Gesellsch., Wien, vol. xvi, p. 605). I have compared several species regarding this point, and I believe that the distinction has hardly subgeneric value; it is not at all constant, neither is the truncate form of the cephalothorax. With reference to Blackwall's new genus *Pasithea*,\* I may mention that this name has been used as a generic denomination already several times; once in botany and twice (by Lamouroux and Lea) in recent and fossil Zoology. The name must be replaced by a new one, though, judging from the description, it is very difficult to trace its generic distinction from *Sphasus*.

The species of this family are readily recognized by their depressed form and the feet strongly bent forward (at least the two anterior pairs). They form two natural groups, one represented by *Thomisus* which has the two last pairs of feet much shorter than the two anterior ones, and the other by *Philodromus* which has all the feet of more equal or subequal size. To this last genus belongs one of our large spiders which is very often seen on the walls of houses &c. &c.; it runs about with the greatest rapidity, and daily consumes a large number of insects, being especially active at night. There are besides a great number of other similar species which occur in our neighbourhood. Several new genera have been lately established through the examination of the Swedish and N. German species belonging to this group.

***Thomisus (Xysticus) pugilis*, Stål., Pl. XIX, Fig. 3.**

♀ Cephalothorax large, subquadrangular, somewhat narrow anteriorly, broader in the middle, with sloping sides and convex edges; uniform pale yellowish green; the front is truncated with projecting edges, above and laterally marbled with brown, and near the upper edge with some more or less confluent whitish spots. The whole of the thorax is covered with very minute pustules from which originate very short white hairs.

The eyes are disposed on the front of the coloured fore part of the thorax. The first pair is situated about the middle of the vertical front, the eyes being rather distant from each other; those of the second middle pair are still more distant than those

\* Ann. Mag. Nat. Hist., 1858, 3rd ser. I., p. 427.

of the first, but nearly of equal size and situated on the upper front edge. The anterior laterals are the largest and situated before the upper lateral projections of the front part of the thorax; those constituting the posterior lateral pair are placed on the same projections near their points, behind and a little below.

The falces are short, thick, greenish, covered with black hairs, and provided with small brownish claws.

The lip is elongated, slightly narrower at the end than at the base. The mandibles are about one-third longer than the lip, narrow, slightly expanded, rounded at the terminations, and thickened at the base, where on the upper external side the thickened palpi are articulated.

The sternum is small, oval, slightly truncated in front, the coxæ of the feet strongly swollen and projecting above the surface of the sternum. The first and second pair of feet are subequal and longer than the third and fourth, being again subequal and not much above half the length of the former. They are like the sternum yellowish green, with a brownish tint towards their terminations; the end of the tibiæ and tarsi have on the inner side a number of strong short spines of a brown colour. The tarsi each have two black strong claws and two opposite smaller, pale coloured ones; on the fourth feet each tarsus, however, has 6 minute black claws.

The abdomen is roundish in front, reaching partially over the base of the thorax; it widens gradually, until in about two-thirds the distance from the front edge, it attains its greatest breadth, marked on either side by a projecting angle; from this it rapidly contracts towards the abdominal point. The colour is uniform pale greenish yellow, with two minute brown dots near each of the angles of the greatest breadth. The edge of the anterior part is finely granulated and some little distance from it runs a row of similar fine granules separated from the marginal row by a groove; in the middle of the abdomen are five minute depressions arranged in form of a triangle with the point directed towards the front. The posterior abdominal end is marked with a few transverse, slightly undulating ridges. The lower surface is on the sides finely corrugated, in the middle flattened, with two slightly converging rows of five minute impressions, situated between the genital pore and the spinners. The trachean opercula are lateral, small, having posteriorly a transverse slit at the end. Of the spinners the posterior pair

is the larger, for the single anterior protuberance has no opening, and there are, therefore, as in the *Epeiridæ*, only two pairs of true spinners.

Length of the thorax 2.7 m.m. ; its width 4 m.m.

————— abdomen 5.5 „ „ ..... 6 „ „

————— one foot of the 1st pair, ... 14.5 m.m.

————— 2nd „ ... 14 „ „

————— 3rd „ ... 7 „ „

————— 4th „ ... 8.5 „ „

♂ The male is extremely small, almost minute when compared with the ♀ ; it is represented on pl. xix, fig. 3c, in its natural size ; the colour and general form does not in any particular respect differ from that of the ♀ ; the palpi are stout, short, the terminal segment being sub-globular, with a large opening below into which the rather thick flagellum is coiled (fig. 3 d) ; the hairs all round the same are blackish and short.

This belongs to the few unicoloured species of the type of *Th. calycinus*, Linn. (*citreus*, Walck.). It has the anterior pair of lateral eyes somewhat larger than the others, but this does not appear, as I have already stated, to be a sufficient reason for instituting a separate genus under the name of *Xysticus*.

Blackwall (Ann. Mag. Nat. Hist., vol. xiv, 3rd ser., p. 38) describes from India another species, *Thom. tuberosus* which is of a brownish colour.

Loc. I found four specimens of this beautiful species inside flowers in the Eden Garden at Calcutta ; not only the form of the thorax but also its coloration strongly reminds one of a minute crab, the backward movements are also those of a characteristic crab-spider ; the specimens generally hide between the anthers where they watch for insects.

### **Thomisus (Xysticus) elongatus, Stol. Pl. XX, Fig. 6.**

♀ Cephalothorax quadrangular, convex, the ocular portion in front truncate, a little narrowed with projecting corners, the posterior lateral margins of the thorax being slightly curved ; a broad white band runs posteriorly, from the antero-lateral corners, it occupies the whole length of the thorax, and is slightly indented with black on each side of its base ; the sloping flanks are brown, and the margins again white with a very thin brown stripe at the extreme edges. The first pair of the

middle, and the corresponding pair of the lateral eyes, are placed on the perpendicular front side of the thorax; the former are on a slight protuberance close together, the latter which are a little larger near the edges below the projecting corners; on the other side, still nearer to the outer point, the posterior laterals are situated, being directed backwards; the posterior central eyes are above, near, but not quite on the front ridge, they are nearly twice as far apart from each other than the anterior centrals; in size they hardly differ.

The falces are very short, broad at the base, gradually tapering towards the tips which are furnished with small simple claws; their length is about equal to that of the sternum, the colour is pale brown.

The lip is rather elongate, broad, subtruncate in front; the maxillæ are about one-third longer than the lip, thick at the base, narrower at the tips with which they converge towards each other.

The palpi are stout, a little more than double the length of the maxillæ; both are pale yellowish brown, thickly set with short stiff hairs towards their ends.

The sternum is subtriangular, truncate in front with roundish corners, gradually becoming narrower posteriorly. The feet of the 1st and 2nd pair are among the largest, and subequal the first being very little longer; those of the 3rd and 4th are again subequal, the fourth which is about equal to only one-half the length of the second pair being slightly longer than the third. The femora are long, sub-cylindrical, very finely granulated; the terminal portions of the tibiæ, and the tarsi of the two first pairs are on the internal side provided with stiff depressed hairs of a brownish colour. Each tarsus of the four anterior feet terminates with four claws, two being stout and black and two smaller, pale brown; on the four posterior feet the claws are much more slender than on the anterior.

The abdomen is sub-cylindrical, slightly narrowed and truncate in front, where it partially covers the base of the thorax; in the middle it is somewhat inflated; pointed and slightly elevated at the posterior end. The general colour is greyish white, produced by numerous short hairs intermixed with others which are stiff and black. There is a conspicuous dark central band with a white stripe on either side; the dark band includes four pairs of indistinct blackish spots, beginning about the middle; near the end is a dark X mark, formed of minute

yellowish dots surrounded with black, and a number of similar spots of yellow and black occupies the posterior end. The upper sides are marked with numerous raised lines, converging towards the terminal upper portion of the abdomen. Below there are a number of similar raised lines, separated from the former by a broad whitish band; they begin at the side of the trachean opercula and converge towards the spinners which are short but prominent, very close together and some distance from the terminal end. Below, the median region is occupied by a similar greyish band as above; the genital opening is very small, furnished on each side with a minute tubercle; the trachean opercula are large, sub-quadrangular, brownish, with a transverse slit at the posterior end.

Length of thorax 2·5 m.m.; its width in the middle 2·15 m.m.

———— abdomen 6    „    „    ————— .....2·3    „    „

Length of one of the first pair of feet, ——— 10·5 m.m.

———— 2nd ————— 10    „    „

———— 3rd ————— 4·5    „    „

———— 4th ————— 5·2    „    „

Loc. Neighbourhood of Calcutta; on trunks of trees, apparently very rare.

**Thomisus Peelianus, Stol. Pl. XX, Fig. 4.**

♀ The cephalothorax of this species is broadly oval, slightly convex, truncate in front, narrower on the sides of the ocular region, and with strongly curved lateral edges; brown above with the margins all round pale yellowish white, and covered with very short hairs.

The anterior part of the thorax, where the eyes are situated, is not markedly raised; the eyes are arranged in two rows, the anterior ones lie on the slope, the posterior above, near the edge. The four middle eyes are small, equal, and form a regular square; the anterior laterals are sensibly larger than any of the middle ones; the posterior laterals exceed the size of the latter by a mere trifle, they are directed backwards, forming with the posterior centrals an easy curve, convex in front. The falces are short, stout, sub-triangular, broad at the base, on the inner side rapidly sloping towards the end, where a large number of short thick hairs exists; they are white, the short fangs being, however, pale brown and their joints pale whitish.

The lip is narrow, longer than broad, subtruncate at the tip; the maxillæ are of about double the length of the lip, also narrow,

converging towards their ends and roundish on the outer anterior edges ; their base is slightly thickened above where the palpi are inserted. The latter are short and thick ; their second joint is the longest, and next to it in length comes the fifth. The lip, maxillæ, and three first joints of the palpi are pure white, the two last joints brownish and thickly set with stiff, dark hairs.

The sternum is almost regularly oval, slightly truncate in front, flat, white. The coxæ are short and thick ; the feet of the two first pairs are almost perfectly equal, the femora are stout and in front granulated. The tarsi have only two joints of which the terminal is much the shorter one. The feet of the two posterior pairs are subequal among themselves, the third being the shorter and not much more than equal to one half the length of one anterior foot. The joints of the tarsi of the two posterior pairs are subequal, the terminal being little shorter than the other. All the feet are white, the anterior halves of the tibiæ (proper) and the tarsi of the four anterior feet are brown, and thickly set with short dark setæ. Each foot terminates with four claws, two large black ones and two smaller opposite pale brown ones ; on the last pair of feet the claws become rather indistinct.

The abdomen is much depressed, narrower and truncate in front, slightly covering the base of the thorax with its edge which bears four small tubercles. Along the lateral and front margin runs a double raised, slightly undulating ridge. The postero-lateral corners are each furnished with two large white tubercles, and a similar large boss occupies the anal end below, while above between the two pairs of tubercles the surface is transversely corrugated, and furnished again with two pairs of shining brown tubercles, the anterior ones being a little more distant than the posteriors. The middle part of the abdomen is excavated, with the central portion again somewhat elevated and studded over with a few impressions for the attachment of muscles. Except the five white and four shining brown tubercles and a white longitudinal central line, the rest of the upper surface is greyish brown. The lower side of the abdomen is white, it has in the centre a few transverse curved sulci ; laterally it is irregularly corrugated, supplied with a narrow prominent ridge and some posterior tubercles ; the epiginium is scarcely elevated, brownish ; the trachean slits transverse, very distinct and lateral to it, somewhat distant from the anterior

end ; the spinners are short, situated on the lower terminal edge and surrounded with an oval raised margin.

Length of the thorax 6·5 m.m. ; its width about the middle, 6·5 m.m.

————— abdomen 7·5 „ „ ; near the posterior end, 9 „ „

————— at the anterior end, ..... 3·8 „ „

————— one of the first pair of feet ..... 20 „ „

————— 2nd ————— ..... 19·5 „ „

————— 3rd ————— ..... 10·5 „ „

————— 4th ————— ..... 11 „ „

Loc. This beautiful species was sent, with a large number of other novelties, to the Indian Museum by Mr. A. C. Peel, an assiduous collector and observer of natural history objects ; it was obtained at Sibsagur, Western Assam.

*Family, SCYTODIDÆ.\**

SCYTODES, Latr.

This genus belongs to the tribe of the *Senoculina* of Blackwall, characterized by the presence of only six eyes. In *Scytodes* these eyes are distributed in pairs on the anterior part of the thorax, one pair lies in front, and one pair on either side somewhat posteriorly compared to the former.

While other *Senoculina*, like *Dysdera* and *Segestria*, are, as regards the form of the body, mostly related to the LYCOSIDÆ (especially to *Lycosa*,) and to the THOMISIDÆ, the *Scytodes* in general character seem to be closely allied to some species of the THERIDIDÆ, an opinion which, if I am not mistaken, has been advanced by Walkenaer. With reference to this point, however, and also concerning the divisions of the *Octonoculina* and *Senoculina* being natural, great doubts may be expressed. I believe that the general character of the body ought in such cases to be considered as more important in a classificatory point of view, than the single character relating to the position of the eyes. The distinction according to these is no doubt convenient, but not always natural. *Scytodes*, when observed sitting in its natural position, has like *Thomisus* the three anterior pair of feet directed forwards, and the posterior stretched obliquely from the body, but also with the intention of a forward movement. In this position the spiders greatly resemble

\* Vide "SCYTODIFORMES," and genus *Scytoda* in Eu. Simon's "Hist. nat. des Araignées," Paris, 1864, p. 43.

some *Philodromi*, so much so, that they could even easily be mistaken one for the other ; they are rather sluggish in their habits, and defend themselves with the feet and falces, when disturbed in their quiet position ; they only spin a few threads but no net.

**Scytodes propinqua**, *Stol.* Pl. XIX., Fig. 4.

♀ The cephalothorax is regularly oval, tumid, highest near the posterior end, higher and equal to, or usually a little longer and wider than, the abdomen, except in old female specimens in which the abdomen becomes slightly larger than the thorax. The general colour is brownish yellow, with two longitudinal dark brown lines extending from each lateral pair of eyes backwards, these undulating lines being more distinct than those at the middle, and at the sides of the thorax which are generally irregularly streaked or marbled with brown. Younger specimens have a very fine, but distinct, central, longitudinal dark line, and two or three similar continuous, curved lines near and parallel to the posterior end and to the sides of the thorax.

The central pair of eyes is on a broad prominence like a rostrum, and the laterals are also placed on oblique prominences which are usually black.

The falces are short and stout, cylindrical, yellowish, with rudimentary brownish claws.

The lip is elongated, obtusely pointed at the end ; the maxillæ, narrow, converging, and little shorter than the falces ; they are not particularly thickened at the base where the palpi are inserted, the latter being thin and, like the former organs, yellowish with a few black hairs near their tips.

The sternum is elongated, oval, flat with minute prominences opposite each coxa, all of which are thickened. The feet are of considerable length and slender, they are yellowish, like the sternum : the femora each have, below, two longitudinal dark lines, and the tarsi possess two segments, the last being the shorter, terminating with two black thin claws. Young specimens have the joints of the various segments of the feet brown.

The abdomen is roundish oval, quite separated from the thorax and not covering its base, very obtusely pointed behind ; it is yellowish white, like the rest of the body thickly covered with hairs, in the

middle with a few pairs of dark dots, to each of which laterally a transverse dark line corresponds. In young specimens there are in the central region usually two single dots, one behind the other; then follow two or three pairs, the dots in each becoming gradually more distant from each other; the lateral lines are very distinct. In full grown specimens the middle dots are in pairs, the posterior very distinct, and the lateral stripes are also replaced by a few dots; only the lower side is uniform whitish; the epigynum is very small and yellowish, the trachean opercula large, brown and situated next to it, the spinners terminal and very little prominent.

Length of thorax ... 3·5 m.m. ; its width posteriorly .. 2·5 m.m.

———— abdomen, 3·8 „ „ ; ——— in the middle 2·7 „ „

———— one foot of the 1st pair ..... 17 m.m.

———— 2nd — ..... 14·5 „ „

———— 3rd — ..... 11 „ „

———— 4th — ..... 14 „ „

This species very much resembles in form and in the general character of colouring the European *Sc. thoracica* (Blackwall's English Spiders, pt. II, p. 380), which has, however, proportionately much longer feet, provided with brown rings, and a somewhat different arrangement of the brown marks on the thorax and on the abdomen.

Loc. Neighbourhood of Calcutta; on shady or dark places between old foliage and in houses. A similar species also occurs in Burmah and at Penang.

### Family *EPEIRIDÆ*.

The spiders included in this family more agree with each other in their general habits, than in any particular structure of the body the form of which is extremely variable. The artful nets made by the *Epeira diadema* are so well known, that I only need to recall the name of this common European species. As a rule, the first pair of feet is the longest, the third always the smallest, the second and fourth are subequal; but in some of the forms with the abdomen hardened above, or strongly coriaceous, the fourth pair is equal to, or exceptionally even a little longer, than the first. The eight eyes are always arranged in two rows: the middle four generally form a more or less regular square, and the lateral eyes are in pairs generally close to each other; there is usually no great difference in the size of the eyes.

The last review of the genera of the EPEIRIDÆ, or ORBITELÆ, was given by Count Eug. Keyserling in 1865, (Verhandlungen der Zool. Bot. Gesellsch., Wien, vol. xv, p. 799 etc.). The author characterized eleven genera which he considered as sufficient for the classification of our then existing materials of the family, but several of the tropical forms will probably have to form generic additions. I possess from India several such species, which I hope to compare more carefully as soon as our means of reference to the literature on the *Arachnoidea* are a little more completed. The late Doleschall already added several genera from the Indian Archipelago, and the examination of the North German, Swedish and Russian spiders are rapidly increasing the number.

*Argiopes* may be considered only as a section, or a subgenus of *Epeira*, because the most important points of the organisation are in both almost identical. It is impossible to fix a proper limit between the elongated form of the cephalothorax of *Epeira* and the rounded one of *Argyopes*, unless we would agree to separate what is called *Epeira* by Keyserling in at least 4 or 5 other genera, and even that number would hardly be sufficient. There is one character in which most of the species classed under *Argyopes* agree, that is, the lateral eyes are contiguous and the anterior of them are very small; but there are again among the true *Epeiræ* similar and even greater variations in the position of the eyes to be met with. Further, most of the *Argiopes* have the tarsi, especially those of the front feet longer than the tibiæ, but cases of this also occur among other *Epeiræ*. Some of Koch's generic divisions should also be retained only as subgenera of *Epeira*.

I shall here give descriptions of a few species belonging to the following genera: *Epeira*, (subg. *Argyopes*), *Nephila*, *Tetragnatha*, *Meta* and *Gastracantha*. In collecting various EPEIRIDÆ I was particularly struck with the very great scarcity of male specimens; for among about 200 specimens belonging to about 30 species there were not more than 5 or 6 males.

***Epeira* (*Argyopes*) *stellata*, Stol. Pl. XVIII, Fig. 6.**

♀ Cephalothorax suboval, truncate in front, posteriorly slightly emarginated; the ocular or cephalic portion is half as wide as the thoracic which is somewhat tumid, and separated from the former by oblique converging grooves nearly reaching to the centre. The sides of the thoracic portion are slightly curved, the upper surface is laterally convex and

somewhat depressed in the middle; the entire surface of the cephalothorax is uniformly covered with short depressed silvery white hairs. Each pair of eyes is situated on a small, but distinct brownish prominence; those of the posterior middle pair are placed somewhat more distant than those of the anterior, and all of them are pretty nearly equal in size; the anterior laterals are very small, situated almost wholly on the under-side of the small tubercles, which bear laterally the hinder pair of the lateral eyes.

The falces are subcylindrical, brown, with short claws and very minute scattered hairs; when in a vertical position they project a trifle beyond the maxillæ, just preventing them from becoming visible in a front view. The lip is short, semicircular, with a very small protuberance in the centre of the internal front side. The maxillæ are twice the size of the lip, thick and hairy on the inner edges. The palpes are rather thickened, like the two former organs yellowish, towards the end covered with somewhat elongated black hairs, and tipped with small black claws.

The sternum is elliptical, rather wide, very slightly emarginated in front, and terminates posteriorly with a small obtuse prominence; it is pale yellowish in the middle, and brownish laterally. A small elongated tubercle is seen near the margin, opposite each of the three anterior pairs of feet.

The first pair of feet is the longest, the third the shortest, being a little longer than one half of the former; the second and fourth pairs are very nearly equal. All the feet are covered with very small silvery white hairs and with scattered shorter and longer blackish spines. The coxæ and femora are yellowish, the tibiæ and tarsi of the two first pairs are banded alternately with brown and yellow; on the third pair, however, these bands become very indistinct, and on the fourth they are replaced by a uniform dark brown hue. The two claws on each of the tarsi are very small, black.

The abdomen is oval, elongated, convex in front, covering the cephalothorax to a considerable extent. Above, the anterior portion, marked with a few minute pits, is silvery white; of the same colour is a longitudinal central band, narrowing posteriorly, and on each side there are four large subquadrangular spots on a black ground, separated by short transverse yellow bands; the last of the four spots is almost obsolete in young specimens. The sides are striped and freckled with

white and yellow. The lower side is black with a yellow elliptical mark, extending from the genital opening towards the anus, and crossed in the middle by a slightly curved band; above this are a few yellow spots. The genital opening is, as usually, situated near the anterior end in a brown hard prominence; the trachean opercula are laterally placed, a little in front of it, they are large and of subtriangular shape; the spinners have five large, black appendages.

Length of the thorax 4 m.m.; its width (posteriorly) 3.5 m.m.

———— abdomen 9.5 „ „ ——— (in the middle) 6 „ „

Length of one foot of the 1st pair ..... 23 m.m.

———— 2nd — ..... 20.8 „ „

———— 3rd — ..... 13 „ „

———— 4th — ..... 19.5 „ „

Loc. Two females, slightly differing in size, were found on bushes in the Sundarbans, a few miles south of Port Canning.

One of the nearest allied species of this *Argyopes* is described by Savigny in the Zoology of the Exped. d' Egypte, (Arachnides, pl. ii, fig. 5), but the abdomen of this one is marked with continuous cross bands and all the feet possess brown and pale bands.

### **Epeira (Argyopes) mammillaris, Stol. Pl. XX, Fig. 12.**

♀ Cephalothorax depressed, not much longer than broad, anteriorly narrow and slightly elevated, the elevation of the ocular region continuing posteriorly as a short ridge which terminates near the centre; the lateral margins are posteriorly curved, and the posterior end is broadly truncated. The whole thorax is thickly covered with very short white hairs, it is brown with a yellow spot in the middle and a smaller one in the centre of the posterior edge; the lateral margins are also yellow.

A small prominence in front bears the four central eyes, two above and two below; they form a regular square and are of equal size; the lateral eyes are a little smaller, than the centrals, they are situated on minute tubercles, and are very little more distant from the posterior centrals than these from each other.

The falcæ are short, stout, brown with blackish claws.

The lip is rather large, roundish at the end and with almost perpendicular sides; the maxillæ are nearly twice as long, narrow at the base, dilated and roundish towards their ends; both are brown.

The palpi are yellowish with a few blackish hairs on the two terminal joints.

The sternum is almost as broad as long, distinctly emarginated at the base of the lip, and roundish posteriorly. Opposite each coxa of the three first pairs of feet is one tubercle, the first on each side being the largest. The colour of the sternum and of the coxæ, which are strongly thickened, is a yellowish brown. The proportion in the length of the feet is as 1, 4, 2, 3, the second and fourth being nearly equal, and the third not more than half the length of the first; in all, the tarsi are longer than the respective tibial joints, they are brownish yellow with the terminal portions of all the joints dark brown.

The abdomen is nearly thrice as long as the thorax, depressed, broadly truncate in front, widest in the middle and obtusely pointed at the posterior end. The posterior halves of the lateral margins each possesses five tubercles: of the three anterior the middle one is the largest, while the two last near the posterior end are very small. The upper surface is of a uniform, dirty brown colour, thickly covered with short white hairs, and provided with a large number of minute dots of which 4 on the anterior part are especially conspicuous; all round the margins the small pits for the attachment of muscles are more numerous than in the middle. The lower side is also of the same general colour as the upper, with a broad, yellowish, longitudinal band extending from the epiginium to the spinners, and surrounding the latter. In the centre of this band is a blackish subquadrangular spot with two pairs of dots, one below the other, one single dot is placed below its lower and another above its upper margin. The trachean opercula are large, shining brown, and so is also a triangular space between them; the pulmonary slits are very narrow. The epiginium is transversely elongated, moderately prominent, brown with black margins round the two sexual pores which lie side by side. The spinners converge with their terminations, forming a broad pointed cone.

Length of thorax 6 m.m. ; its width in the middle 6 m.m.

———— abdomen 12 „ „ ; ————— 11 „ „

———— one foot of the first pair ..... 25.5 m. m.

———— 2nd ——— ..... 24 „ „

———— 3rd ——— ..... 11.5 „ „

———— 4th ——— ..... 24 „ „

This species may be considered as the eastern representative of *Epeira sericea* (Walkenaer, Insect. Apt., vol. ii, p. 116), which is found in Egypt, and almost through the whole of Northern and Western Africa; the former differs from the latter by a shorter thorax and the want of numerous bands on the feet; the abdomen is also not emargined in front, and the anterior lateral edges are not serrated, what they always appear to be in the African form.

Loc. Gowalparah in Western Assam. One specimen was sent with many other interesting forms of insects by Mr. H. Haughton; the species also occurs in Burmah and all along the Malayan Peninsula.

***Epeira braminica*, Stol. Pl. XX, Fig. 8.**

♀ Cephalothorax longer than broad, convex, narrowest at the ocular region, widest near the posterior end which is again somewhat contracted at its extreme termination; pale yellowish with three longitudinal brown stripes, one central and one marginal on either side.

Ocular region truncate and roundish, not elevated at all; the four central eyes form a small square in the middle, and the laterals are almost contiguous, distant, placed at the corners. The falces are somewhat elongated, thick at the base, and gradually tapering towards the ends, yellowish, laterally at the base with a short longitudinal stripe; the claws are rather long and brown. The length of the falces is nearly equal to that of the sternum.

The lip is short, semicircular, obtusely pointed in the centre; the maxillæ are much higher, broader and rounded; the palpi are inserted at their upper bases which are not specially thickened;—all these organs are pale yellowish, the last have a few black short hairs near their ends, and the former a number of similar hairs at their inner edges.

The sternum is a little longer than broad, truncate anteriorly, and rapidly terminating with a short point posteriorly, with a small tubercle opposite the insertion of each of the three anterior pairs of feet; it is black with a yellowish central longitudinal stripe. The feet are rather short and stout, furnished with very short, white hairs, and some longish black spines; the first pair is the longest, the 2nd and 4th are subequal, and the 3rd the shortest; the length of one of the third pair is equal to two thirds of one of the first; all feet are yellowish, with the terminal ends of the femora, tibiæ and tarsi blackish brown. The tarsi are thin, the claws very short and black.

The abdomen is almost regularly oviform, tumid, slightly covering the base of the thorax, nearly twice as long as the last; it is covered with numerous short, depressed, white hairs. The upper side is brown, with a central longitudinal yellowish mark, in shape very much resembling the from of a sword; about the middle there are two white dots on each side, one below the other. The sides are pale brown, and the central portion below dark brown, with two undulating longitudinal yellow marks, extending from the epiginium to the spinners. The latter have five appendages, one single largest in front and two pairs next to it posteriorly. The trachean opercula are subtriangular, large, situated near each other at the front edge. The genital opening lies some distance from this edge, on the inside of a dark brown strongly raised claw, resting on an inflated, pale coloured tubercle.

Length of the thorax 3 m.m.; its width about the middle 2.4 m.m.

————— abdomen 8 „ „ ; ————— 5.5 „ „

Length of one of the 1st pair of feet ..... 15 m.m.

————— 2nd ————— ..... 13.8 „ „

————— 3rd ————— ..... 9.5 „ „

————— 4th ————— ..... 11 „ „

The species is in many respects allied to the well known *E. apoclis*, which has a geographical distribution from North America and Sweden to Egypt; it is, however, readily distinguished from it by the shorter thorax in proportion to its length, and by its markings above and below; the colouring of the abdomen is also somewhat different.

Loc. Calcutta. The only female was found in a godown, and although I had repeatedly instituted a search after this beautiful species, I never obtained a second specimen of it.

### ***Epeira hirsutula*, Stol. Pl. XX, Fig. 13.**

♀ Cephalothorax slightly longer than broad, rather high and convex, narrowest in front and gradually becoming wider, being widest near the posterior end which is broadly truncate;—general colour uniform brownish yellow.

Ocular region slightly elevated at the frontal superior edge. Of the central eyes those of the anterior pair are a little closer together than the posterior ones; the laterals are somewhat smaller, nearly contiguous, but distant from the former.

The falces are as compared with the size of the spider large, considerably higher than the front side of the thorax, yellowish, with brown short and thick claws.

The lip is very small, semicircular; the maxillæ considerably larger, wide at the base, subtriangular, and converging with their ends; the palpi are inserted at the upper bases, they are equal to double the length of the falces. The lip is brownish, the maxillæ and palpi yellowish, the last being only at their extreme tips brown.

The sternum is sub-oval, somewhat truncate in front, very little longer than the falces, and of greyish brown colour. The feet are of moderate size, their proportionate length is as 1, 2, 4, 3, the 2nd and 4th being subequal, and the 3rd equal to two-thirds the length of the fourth; all are uniformly yellowish, brownish at the tips of the tarsi, each of which is supplied with 4 very minute claws.

Abdomen sub-pentagonal, truncate in front and slightly covering the base of the thorax, widest and subangular in the middle, obtusely pointed and somewhat raised posteriorly. The general colour is brownish, marked all over with small white specks, posteriorly with a central longitudinal somewhat branching line, and laterally with a few indistinct transverse dark spots. The lower side is brownish, with four silvery white spots, forming a quadrangle between the epiginium and the spinners; the former is very little, the latter are strongly prominent, and of considerable length. The whole of the body, including the thorax and the feet, is thickly covered with somewhat elongated white hairs.

Length of thorax 1.8 m.m. ; its width posteriorly 1.6 m.m.

———— abdomen 4.5 „ „ ; ————— ..... 4 „ „

Length of one foot of the 1st pair ..... 9 m.m.

————— 2nd ——— ..... 8.5 „ „

————— 3rd ——— ..... 5.8 „ „

————— 4th ——— ..... 7.8 „ „

Loc. Calcutta; a rare species on walls in the interior of houses; the male has not yet been observed, it seems to be very scarce.

#### NEPHILA, *Leach*.

The species of this genus may be considered intermediate between *Epeira* and *Tetragnatha*, as regards the form of the body as well as that

of the falces, but the feet are much longer than in the former genus, the tarsi being also longer than the tibiæ, as has likewise been noticed in the subgenus *Argyopes*.

**Nephila angustata**, *Stol.* Pl. XX, Fig. 7.

♀ Cephalothorax longer than broad, anteriorly bluntly truncated and somewhat narrow, two converging furrows separating the ocular portion from the posterior one, which has the lateral edges curved and tinged with brown, as likewise the central region, being distinctly depressed, while the rest of the surface is pale yellowish and convex.

The eyes are placed quite near the anterior end, but not on special tubercles; of the four middle ones the anterior are situated very little closer to each other than the posterior, they are all of equal size. The laterals are smaller, almost touching each other, arranged in about the same line as the posterior middle ones, but more distant from them than these among themselves.

The falces are cylindrical, thick, not much longer than broad, yellowish with brown ends and short brown claws; their length is equal to that of the sternum; when in a vertical position they project a little beyond the maxillæ.

The lip is thick, narrow, with parallel sides, obtusely rounded in front; the maxillæ are about twice as long as the lip, somewhat narrower at their base and curved outward, being concave on the outer- and convex on the inner side; both are dark brown. The palpes are thin, greenish, with long blackish hairs towards their ends.

The sternum is narrow, truncate in front and pointed behind, brown, with small tubercles opposite each of the first and the third pair of feet. All feet are remarkably slender, the first pair being longer than the second, then comes the fourth; the third being, as is usual, the shortest and about equal to one half of the second pair; all are greenish in fresh specimens, becoming yellowish after they had been for a time in spirit, with the tibial and tarsal joints brown; in some specimens the tarsi are distinctly brown even in a fresh state.

The abdomen is elongated, subcylindrical, high, anteriorly with two obtusely rounded black protuberances, strongly projecting over the end of the cephalothorax; the posterior end is obtusely pointed, elevated above the spinners and concentrically corrugated. The general

colour, above, is silvery white, posteriorly with a yellowish or golden tinge. There are three parallel longitudinal black stripes, the central one connected about the middle with each lateral one by two short and diverging, dark stripes.

The sides are marked each with one long white stripe, originating anteriorly and terminating at the spinners; a second white but short stripe begins near the posterior end; the rest of the sides and the surface below is black. On the latter there are three longitudinal white stripes between the sexual opening and the spinners; the central one of these is often rather indistinct, the middle portion of the abdomen possessing a conspicuous emerald green spot, while in continuation of the lateral stripes there are two white dots on either side of the spinners. The epigynum is blackish brown, slightly prominent, posteriorly provided with two minute points.

Length of the cephalothorax 5 m.m.; its width in the middle 4 m.m.

————— abdomen 8.5 ,, ,, ; ————— 4 ,, ,,

Length of one foot of the first pair ..... 24.4 m.m.

————— 2nd ——— ..... 24 ,, ,,

————— 3rd ——— ..... 12.5 ,, ,,

————— 4th ——— ..... 16 ,, ,,

Loc. Neighbourhood of Calcutta, not common on bushes or high grasses; it has also been obtained by Mr. Peel at Sibsagor in Assam. All the specimens that I have examined were females.

### **Epeira (Nephila?) cicatrosa, Stöl. Pl. XX, Fig. 5.**

♀ The cephalothorax is longer than broad, tumid, the ocular portion being the smaller one, oval, well margined; the posterior is somewhat depressed along the longitudinal line, and convex on either side of it; the general colour is pale greenish, with a broad brown band along the centre, and two stripes one parallel to each of the curved margins; a short streak runs from each of the posterior eyes disappearing posteriorly at the end of the ocular region of the thorax.

The central eyes are rather distant, the anterior being a little smaller than the posterior; the lateral eyes are close together, but distinctly separated, and placed on about the same line with the posterior centrals, but nearer to these than they themselves are from the anterior centrals.

The falcæ are cylindrical, somewhat longer than broad, pale greenish slightly narrowed towards the tips, and furnished with short brown claws.

The lip is very small, semicircular; the maxillæ much larger, sub-quadrangular, flattened, roundish anteriorly, slightly widened at the base where the thin palpi are inserted; the former two organs are brownish, the latter pale yellowish or greenish with a few black stiff hairs towards their tips.

The sternum is longer than broad, truncate anteriorly, pointed posteriorly, with a slight prominence opposite the base of the lip and that of each coxa of the three anterior pairs of feet; it is deep black, generally with a longitudinal central yellowish streak, and on its entire surface thickly covered with short hairs.

The feet do not vary greatly in length: the first is the longest, the second and fourth are almost perfectly equal, but not much shorter than the first, and the third is about equal to three-fifths of the first; they are greenish with minute black dots, giving origin to longer and shorter black hairs, and with a few longitudinal black lines on the femora, especially conspicuous on their upper sides.

The abdomen is somewhat longer than the thorax, the base of which it slightly covers with its truncated front edge. On the anterior upper portion it has two pairs of pointed prominences, those of the posterior pair being a little nearer to each other than the anteriors. These prominences are, at least on the inner sides, black, but the surface between and all round them is marbled and streaked with white, reddish and partially with black; the surface near the posterior end, which is raised above the spinners, is blackish brown with a few paler, very fine transverse lines. The sides of the body are finely streaked with black and white. The inferior side is blackish brown with a white streak on each side, running in a slight curve from the sexual opening to the spinners; besides these, two small distant white spots are to be observed below the epigynum, two pairs of similar spots in the middle between it and the spinners, two larger white spots on each side of the spinners and two white streaks running from the prominent spinners to the end of the body. The epigynum is very little raised and brown.

Length of thorax 2.7 m.m. ; its width in the middle 1.9 m.m.

———— abdomen 4    „    ; ————— 2.2    „

———— one of the first pair of feet ..... 11 m.m.

|                                              |     |      |
|----------------------------------------------|-----|------|
| Length of one of the 2nd pair of feet, ..... | 10  | m.m. |
| ————— 3rd ————— .....                        | 6.8 | „ „  |
| ————— 4th ————— .....                        | 10  | „ „  |

It is difficult to place this species in either of the genera *Nephila* or *Epeira*, being intermediate between both, and showing that the distinction of the two genera is by no means so strict as would be desirable; it has the proportionate length of the feet of an *Epeira* and the long falces of a *Nephila*; to the last genus it, however, shews in other respects a greater relation than to the former.

Loc. Found in shady places between hedges and framework about Calcutta, chiefly in gardens. I first obtained this very interesting form through my friend, Mr. H. Bennertz, who procured a large number of specimens, all of which were females and mostly full grown. It builds a large snare, and lives to a certain extent social, but it does not grow to a large size.

#### META, Koch.

The species of this genus are in external appearance perfectly similar to those of *Tetragnatha*, the principal distinction of *Meta* being the position of each of the two lateral eyes on a common tubercle. To the species quoted by Keyserling (Zool. bot. Gesellsch., Wien, 1868, XV, p. 830) as belonging to this genus I shall add presently one to all appearance new species, from the neighbourhood of Calcutta.

#### *Meta gracilis*, Stol. Pl. XIX, Fig. 2.

♀ Cephalothorax elongated, scarcely half as long as the greatest width at the middle; ocular portion narrow, elevated above and shorter than the thoracic portion, from which it is separated by converging grooves; the thoracic part is slightly convex, impressed in the centre, with convex sloping sides and very little curved margins.

The eyes are placed near the anterior end of the cephalothorax; of the middle pairs the two anterior eyes are smaller and closer together, than the posterior. Each two lateral eyes are nearly contiguous, situated on small prominences, the posteriors being a little larger and more distant from each other than are the anteriors. The distance

between the lateral and the posterior central eyes is almost greater than that between the latter and the anterior centrals.

The falces are little shorter than the thorax, somewhat depressed, furnished with very strong, slightly curved claws lying in grooves provided with strongly serrated edges.

The lip is small, roundish at the tip; the maxillæ narrow, flattened, with their terminations curved outwards, and nearly double the length of the lip. The palpi are thin, about half as long as the falces, thickly set with blackish hairs, especially towards their ends.

The sternum is oval, somewhat elongated, sub-truncate in front and pointed behind, slightly emarginated at the places where the coxæ are inserted; the latter being rather thickened. The feet are of the usual proportionate length, the first being by far the longest (equal to double and a half the length of the abdomen and thorax together); then comes the fourth, then the second, the third being scarcely longer than the abdomen. The colour of all the parts mentioned is a pale brown, darker about the region of the eyes, on the falces, on the lip and at the terminal joints of the feet; the maxillæ are pale.

The abdomen is subcylindrical, perfectly separated from the thorax, anteriorly slightly thicker, and posteriorly curved upwards: dark brown, finely reticulated with a silvery whiteness throughout; along the centre of the sides runs a narrow thin black line, accompanied above and below by a distinctly whitish undulating line; another white line is seen along the lower margin of the abdomen, and the central portion of the latter is occupied by a black band; a very conspicuous white spot is situated laterally near the base of the spinners, which are dark brown and very little prominent; the epiginium is small, the trachean opercula large, subtriangular, rather distant from the anterior end; both are of a light brown colour.

Length of cephalothorax 2.4 m.m. ; its width 1.3 m.m.

———— abdomen 6.7 „ ; ——— 1.5 „

———— of the first pair of feet ..... 22 m.m.

———— 2nd ——— ..... 13 „

———— 3rd ——— ..... 7 „

———— 4th ——— ..... 13 „

Loc. The only specimen was found near Calcutta, in an old tree where it had formed a small loosely built snare.

TETRAGNATHA, *Walek.*

A large number of the Indian species belonging to this genus are distinguished by a long, narrow and subcylindrical body, closely resembling in this respect, as well as in the bright colouring, the European *Tetragnatha*, Linné. Count Keyserling gave a review of most of the known species of *Tetragnatha* (Zool. Bot. Gesellesch., Wien, 1868, XV, p. 835 etc.). He enumerates 15 species, accompanied by detailed descriptions; most of them are European or American. The review is, however, not to be considered a complete one, for there are numerous other species described by A. Adams (Ann. Mag. Nat. Hist., 2nd ser., vol. vii), by Doleschall, Blackwall, and others. The only question regarding these species to decide would be, whether they really are *Tetragnathæ*, or whether they belong to any of the allied genera. Blackwall described lately an Indian species, *Tet. decorata* in Ann. Mag. Nat. Hist., 1864, 3rd ser., vol. xiv, p. 44.

***Tetragnatha irridescens*, Stål. Pl. XVIII. Fig. 3.**

♀ Cephalothorax about one-third longer than broad, having the ocular portion considerably narrowed posteriorly; the thoracic oval, with curved sides and slightly more contracted at the base, depressed about the centre towards which numerous dark brown lines converge; the general colour is light, almost fleshy brown, and the whole surface covered with very short whitish hairs.

The eyes are placed near the anterior truncate edge of the thorax in two almost parallel rows, very slightly curved forward; those of the anterior middle pair are a little more prominent than others, and the anterior lateral eyes are the smallest, the remaining being of pretty nearly equal size.

The falces are long, subcylindrical, somewhat depressed, light brown with strong dark brown claws, lying in grooves with serrated edges.

The lip is short, semicircular with the edge somewhat bent outward; the maxillæ are about three times as long as the lip, and half the length of the falces, somewhat dilated and curved outwards at their ends; the palpi are filiform inserted above at the base of the maxillæ which are, however, not thickened at this place.

The sternum is heart-shaped, elongated, posteriorly pointed, slightly convex, smooth and indented at the places of insertion of the coxæ.

The feet are very slender, clothed with thin whitish hairs, and a few longer blackish spines intermixed; their proportionate length is the same which characterizes the genus; they are like the sternum light brown with the terminations of the joints somewhat darker. The abdomen is regularly cylindrical, slightly turned upwards at the end, a little more than three times as long as broad; blackish, finely reticulated with silvery white and green dots; above, a very narrow black line runs along the centre, giving off other short oblique lines; the ventral portion is occupied by a longitudinal broad black band, which extends over the slightly prominent epigynum and the spinners.

♂ The male does not appear to differ in size from the female; it has the falces a little stronger, the cephalothorax somewhat darker brown; and on the abdomen of the specimen, examined, I did not observe any dark dorsal line. The last joint of the palpi is long, strongly thickened, and gradually attenuating towards the end; the flagellum is short, simply curved and slightly thickened terminally.

♂ Length of the cephalothorax 1.7 m.m.; its width

in the middle 1 m.m.

———— abdomen ..... 4.3 ,, ,, ; ..... 1 ,, ,,

———— one of the 1st pair of feet, .. 21 m.m.

———— 2nd ,, ..... 12 ,, ,,

———— 3rd ,, ..... 6.5 ,, ,,

———— 4th ,, ..... 10 ,, ,,

This species appears to be the eastern representative of the common European *T. extensa*, which is also known from Africa and Western Asia; it can be, however, readily distinguished from the latter by the greater length of the cylindrical abdomen in proportion to that of the thorax, by the smooth sternum, less diverging falces, &c.

Loc. Neighbourhood of Calcutta; rare, on foliage.

### GASTRACANTHA, Latr.

*Subgenus*, ISACANTHA, Sim. (Hist. nat. des Araignées, p. 286.)

Simon suggests the formation of a number of subgenera of *Gastracantha* according to the number and proportionate length of the spines of the abdomen. In the present form there is one pair of spines on either side and one pair posteriorly, all the spines being very nearly, or perfectly, equal in length.

**Gastracantha (Isacantha) Canningensis, Stol.**

Pl. XVIII., Fig. 1.

♀ Cephalothorax quadrangular, nearly twice as broad as long; above in the middle, at the anterior and posterior edges, and at the anterior corners somewhat prominent; upper surface covered with small hairs; uniform brown.

The anterior central eyes are situated in front on the median projection of the thorax, the posterior ones are somewhat higher, and very little more distant from each other, than are the former among themselves. The lateral eyes are placed together on each of the lateral projections; the anterior ones are much the largest of all, and the posterior ones so small as to be hardly conspicuous. The falces are short, very thick, inflated, vertical, with strong articulated claws, fitting into a groove with finely serrated edges; both are brown, the claws blackish. The lip is minute, semicircular, slightly angular at the tip; the maxillæ much larger, thick, roundish, bent outwards; the palpi are rather short, inserted at the upper external bases of the former, both are light brown. The sternum is subtrigonal, somewhat elongated, truncate in front and pointed behind. The feet of the fourth pair are the longest, about equal to the total length of the body, those of the first pair are somewhat shorter, the second again shorter, and the third the smallest. All the coxæ are very short and thick, the femora broadly flattened with rather sharpened anterior edges. The general colour of the feet is brown, the coxæ and the thickened ends of the joints being blackish, and covered with short hairs. The claws of the tarsi are very small and black.

The abdomen is above coriaceous, hardened, anteriorly with a convex margin, and a very small central notch; on each side are two thick protuberances, inflated and turned upwards, and terminally provided with very small dark spines, the anterior of which is slightly smaller than the posterior; the posterior margin is entire, slightly rounded, and higher than the anal end which terminates with two thick diverging almost horizontal processes, each also supplied with a small spine. The whole surface is punctured and covered with very short hairs: along the anterior margin there are eight black oval impressions; one, the largest, is situated between each of the lateral processes, and nine are along the posterior margin, the first of them beginning on

either side at the hinder portion of the posterior lateral process. In the middle of the carpace there are two rounded depressions between the two anterior lateral processes, and two between the posterior ones, somewhat more distant than the former. Above each of the lower impressions there is a large yellowish spot, and above this laterally a very small groove. In the central longitudinal line of the carpace are placed four little punctures, one below the other, and then two pairs of equally small ones, situated between the two posterior lateral processes. Beside these there are a number of other small punctures or impressions, but they do not appear to be regular and constant. The prevalent colour of the upper surface of the carpace is yellowish brown, tinged with a reddish hue, produced by short hairs; these being, however, very easily worn off.

The lower surface is strongly convex, deeply corrugated with narrow furrows; the five spinners are black surrounded by a raised roundish oval edge; a very strong vertical and pointed protuberance is situated in front of the genital opening, with the roundish trachean opercula laterally and deeply placed.

Length of cephalothorax 1.5 m.m.; its width 3.2 m.m.

———— abdomen without posterior spines 5.5 „ „

Width of the same measured between the two lateral spines 8 m.m.

Length of one of the 1st pair of feet ..... 5 „ „

———— 2nd ————— ..... 4.8 „ „

———— 3rd ————— ..... 4.5 „ „

———— 4th ————— ..... 7.5 „ „

This species appears closely to resemble *Gast. helva*, Black., (Ann. Mag. Nat. Hist., XIV, p. 42) from which it can be distinguished by the thick processes with very short spines, the want of streaks on their underside, nine equally large, instead of ten, posterior marginal depressions of which the two central ones are minute, by the vertical process before the genital opening, by the want of a longitudinal furrow on the thorax, etc.

Loc. A single specimen was found a few miles South of Port Canning (S. E. of Calcutta) on bushes, where it had made a small snare between the leaves.

## EXPLANATION OF PLATES.

## PLATE XVIII.

Fig. 1.\* ♀ *Gastracantha (Isacantha) Canningensis*, Stol., p. 248; 1, upper-, 1 a, lower view, 1 b, frontal view of a portion of the cephalothorax, shewing the relative position of the eyes, the size of the falces, &c.;—all figures are drawn to twice the natural size.

Fig. 2. *Gagrella atrata*, Stol., p. 213; 2, upper view in natural size; 2 a, and 2 b, upper and lower views in four times the natural size; 2 c, side view of the smooth ocular tubercle with one eye.

Fig. 3. ♂ *Tetragnatha iridescens*, Stol., p. 246; 3, upper view, natural size; 3 a, upper view of the front part of the thorax with the two rows of eyes, the falces and palpi &c., enlarged 6 times; 3 b, side view of the terminal joint of the left palpus with the small flagellum coiled in, enlarged 8 times.

Fig. 4-5. ♂ & ♀ *Galeodes orientalis*, Stol., p. 209; 4 and 5, upper views in natural size; 4 a, internal view of the metatarsal and tarsal joints of the left palpus, three times the natural size; 4 b, side view of the tarsal joint only; 5 a, side view of the body of the ♀, shewing the appendage of one of the falces and 6 appendages of the coxa and femur; 5 b, view of the internal side of the tarsal joint of ♀, three times natural size.

Fig. 6. ♀, *Epeira (Argyopes) stellata*, Stol., p. 234; 6, upper view, natural size; 6 a, frontal view of the ocular portion of the thorax, shewing the distribution of the eyes, the proportions of the falces, length of the palpi, &c.

## PLATE XIX.

Fig. 1. *Telyphonus Assamensis*, Stol., p. 205; 1, upper view of a full grown specimen, natural size; 1 a, front view of the mouth with the penultimate joints of the cheliceres; 1 b, upper view of the anterior portion of the thorax; 1 c, basal joints of the cheliceres, as seen below; 1 d, the three right lateral eyes in their relative position; (1 a—c, are enlarged twice the natural size); 1 e, a portion of the metatarsal and the tarsal segments with the terminal claws of the second left foot; 1 f, a portion of the metatarsal and the tarsal segments of the first right foot;—(1 e and 1 f, are enlarged four times).

Fig. 2. ♀ *Meta gracilis*, Stol., p. 244; 2, upper-, 2 a, lower view, twice the natural dimensions; 2 b, ocular portion of the thorax shewing the disposition of the eyes; 2 c, view of the falces and the maxillæ and also shewing the outline of the lip,—(2 b and 2 c, are enlarged four times).

Fig. 3. ♀ *Thomisus pugilis*, Stol., p. 225; 3, upper view; 3 a, frontal view of the ocular portion of the thorax with the falces and palpi; 3 b, shewing the sternum, the lip, maxillæ and the two basal joints of the palpi; all figures are enlarged three times; ♂, 3 c, upper view, natural size; 3 d, inner view of the two terminal segments of the right palpus with the long flagellum coiled in a large cavity.

Fig. 4. ♀ *Scytodes propinqua*, Stol., p. 232; 4, 4 a, 4 b, upper-, side-and lower views, twice the natural size; 4 c, frontal view of the ocular portion of the thorax, shewing the position of the eyes,—enlarged four times.

## PLATE XX.

Fig. 1. ♀ *Sphasus viridanus*, Stol., p. 220; 1, upper view, natural size; 1 a, relative position of the eyes; 1 b, front view of the head and of the falces; 1 c,

\* In all figures the feet are drawn in their full lengths.

lower view of the lip and maxillæ ;—(1 *a*, is enlarged three times ; 1 *b* and 1 *c*, are enlarged twice).

Fig. 2. ♀ *Spharus similaris*, Stol., p. 222 ; 2, upper view, natural size ; 2 *a*, lower view shewing the relative length of the lip, maxillæ and falces ; 2 *b*, eyes.

♂, 2 *c*, inner view of the 4 last joints of the right palpus, shewing the flagellum in the last inflated segment,—enlarged six times.

Fig. 3. ♀ *Dolomedes longimanus*, Stol., p. 218 ; 3, upper view ; 3 *a*, position of the eyes, twice the natural size ; 3 *b*, lip, maxillæ and basal joints of the palpi, enlarged three times.

Fig. 4. ♀ *Thomisus Peelianus*, Stol., p. 229 ; 4, upper view, natural size ; 4 *a*, eyes ; 4 *b*, lip, maxillæ and basal joints of palpi ; enlarged twice.

Fig. 5. ♀ *Epeira cicatrosa*, Stol., p. 242 ; 5, upper view ; 5 *a*, side view of another specimen,—both enlarged twice ; 5 *b*, eyes and 5 *c*, lip, maxillæ and basal joints of the palpi—enlarged four times the natural dimensions.

Fig. 6. ♀ *Thomisus elongatus*, Stol., p. 227 ; 6, upper view, enlarged twice ; 6 *a*, front part of the ocular portion of the thorax with the eyes ; 6 *b*, lip and maxillæ &c.,—enlarged three times.

Fig. 7. *Nephila angustata*, Stol., p. 241 ; 7, upper view, natural size ; 7 *a*, anterior part of the ocular portion of the thorax, shewing the relative position of the eyes,—enlarged ; 7 *b*, front view of the ocular portion with the falces, slightly enlarged ; 7 *c*, lip, maxillæ and basal joints of the palpi, twice the natural size.

Fig. 8. ♀ *Epeira braminica*, Stol., p. 238 ; 8, upper view, natural size ; 8 *a*, relative position of the eyes ; 8 *b*, lip and maxillæ ; 8 *c*, front and side views of the epigynum,—all enlarged.

Fig. 9. *Hersilia Calcuttensis*, Stol., p. 216 ; 9, upper view, natural size ; 9 *a*, eyes ; 9 *b*, front view of the ocular portion of the thorax with the full length of the falces ; 9 *c*, lip, maxillæ and basal joints of the palpi ;—all enlarged.

Fig. 10. *Gagrella signata*, Stol., p. 214 ; 10, upper view of the body, shewing the cheliceres, palpi and the coxæ, enlarged three times ; 10 *a*, side view of the body, and 10 *b*, the left second foot,—both in natural size.

Fig. 11. *Gagrella atrata*, Stol., p. 213 ; upper view of a short, but most common variety, enlarged three times.

Fig. 12. *Epeira (Argyopes) mammillaris*, Stol., p. 236 ; 12, upper view, natural size ; 12 *a*, eyes ; 12 *b*, front view of the ocular portion of the cephalothorax ; 12 *c*, lip, maxillæ and basal joints of the palpi,—all enlarged.

Fig. 13. *Epeira hirsutula*, Stol., p. 239 ; 13, upper view, three times natural size ; 13 *a*, eyes ; 13 *b*, front view of the ocular portion of the thorax and the falces,—enlarged.

*Analysis of the Khettree Meteorite with an account of its fall,*  
by D. WALDIE, Esq., F. C. S.

[Read and received 2nd June, 1869.]

The Meteoric stone of which the analysis is given in the following pages, fell near Khettree, Rajputana, and the sample was supplied to me by Mr. W. Stotesbury of the Topographical Survey, who at the same time communicated an interesting account of the circumstances of the fall, of which he was to some extent personally cognisant. The account I shall give in his own words from his letter to me.

“Whilst employed in making a Topographical Survey of a portion of Shekawattie in Rajputana in February 1867, (I forget the exact date)\* I was out at work one morning at about 9 o'clock ; I was suddenly startled by a loud report resembling that of a cannon at Khettree, the seat of a petty prince, about 11 miles distant to the south of the place where I was then working. The first report was followed by two more, louder than the first, but a little to the east of the place where I imagined I heard the first report ; these three were succeeded by a regular roll, resembling musketry heard at a short distance. The day being a beautiful bright one, and no clouds to be seen anywhere, and also seeing no stones falling, I did not know what to make of this, to me, strange atmospheric phenomenon. I immediately communicated the above facts to the Editor of the *Delhi Gazette*, asking to know what these strange reports in the air meant and the cause thereof. The day after I had posted the letter, I was informed by some villagers that the day before, they heard the reports, and that a shower of Aerolites had fallen, and that the stones had been seen by them. Mr. Robert Todd, a friend of mine, and in the same survey party as myself, seeing my query in the *Delhi Gazette*, regarding these reports, wrote to the Editor of the above paper informing him that they were caused by a fall of Aerolites ; he was at that time working about ten miles to the east of me, and describes the reports, &c., the same as I have mentioned already. The showers of stones, as I learned afterwards from the villagers, amounted to about 40, which fell chiefly near a village called “Saonlod,” 3 miles to the north of

\* Mr. Stotesbury has since found from an entry in one of his books that the date was 19th January, 1867.

Khettree in Shekawattie, Rajputana, Lat.  $28^{\circ} 9' 45''$  N., Long.  $75^{\circ} 51' 20''$  E., and about 90 miles S. W. of Goorgaon near Delhi."

"The natives, not knowing what to make of these stones, and being just as superstitious, if not more, than all natives of India, put it down to the vengeance of some offended deity: they, therefore, set about gathering all the stones that they could find; these, they afterwards pounded down to powder and scattered this to the breeze, &c., so as not to let the vengeance of the offended god redound on them. No sooner did I hear of the fall of the stones, and ascertained the exact locality, I sent all the sowars attached to my camp, to scour the country round about the place, with the intention of procuring as many of the stones as possible. I was very nearly too late, as between them all, they only managed to get the piece I sent down to you, and that by a promise of a large reward. I cannot fully describe to you the fear of the inhabitants of the villages adjacent to where the stones fell, and their amusing and queer descriptions as to their ideas of the cause, and nature of the Aerolites."

"I am sorry I had not an opportunity of viewing one of the stones before they had been broken by the foolish villagers, as I should have then been able to give you the real size, &c., of them; but from descriptions given me by the more respectable class of natives, I should say the stones were about the size of a 24-pounder shot, quite round, with a blackish appearance on the outside, and impregnated with a sulphurous smell. They fell with such velocity that they sank two or three feet into the ground, a sandy soil. The men who gave me these descriptions, I summoned and questioned them myself; of course as is natural with natives, I received all sorts of communications regarding the fall of the stones, but they are not only as foolish as they are untruthful, so it is no use my giving them you. The descriptions I have now given you, may be relied on, as they are collected by myself, from personal interviews with the more informed and respectable class of natives, such as Mahajans, Pataels and the Raj officials; and I only kept those descriptions that tallied with others I had previously received from others."

The stone is partly of a light bluish grey colour, partly of a much darker grey, in some places the two portions lying in contact like two strata, in others nodules of the one imbedded in the other. The broken

surface is studded over with metallic particles, many of them having a bright metallic lustre, and there are also observable by aid of a lens, spots of a yellowish or brown colour from oxidation of the Iron, and granules of a greenish yellow colour and translucent appearance, probably Olivine. Spherules of earthy matter are also visible and round cavities in which others have been imbedded. When coarsely powdered the spherules are more visible, and when more finely powdered and examined under water with the lens, the lighter portion of the stone exhibits a considerable quantity of a nearly white crystalline matter, the particles of which are tolerably uniform in size, mixed with small angular fragments of black, brownish, opaque and greenish yellow translucent minerals, and irregularly shaped but rounded particles of Iron. The dark grey portion exhibits the same appearances, but with a much larger proportion of dark-coloured earthy minerals. The particles of the iron having resisted trituration now appear much larger than the others. After the metallic matter has been removed by acid, the remainder seems to consist of the white fine crystalline matter, observed in the original light grey portion of the stone, mixed with a few black particles. The stone is not very hard, and but for the particles of Iron, is not difficult to powder.

It is covered with a dark grey nearly black crust, cellular on the surface and corrugated somewhat longitudinally, and of about one third of a millimetre thick.

Many of the older analyses of Meteorites are very imperfect, being very defective even in the detection and estimation of the chemical constituents. Of late the chemical examination has been much more complete, and improvements have been made in their proximate analysis, obviously a matter of the greatest interest. The most recent of these investigations have been the very valuable ones by Daubrée and Meunier of the Museum of Paris, chiefly on Meteoric Iron, for the separation of the uncombined metal from the sulphides and phosphides and other constituents. As my attention had not been previously directed towards the analyses of Meteorites, I did not notice their papers so early as would have been desirable, and lost time and labour in the first processes employed. The separation of the earthy minerals is still very imperfect, and there are no very obvious means available for this purpose.

The general plan of analysis followed was to act upon the powdered stone first by acid solvents, and afterwards to extract the Silica set free from combination by boiling with solution of Carbonate of Soda. The matter resisting the action of these agents was attacked in the usual way by fusion with alkaline carbonate or with baryta. The boiling with Carbonate of Soda was troublesome, the solution could not be filtered perfectly clear: it always carried with it a small portion of undecomposed mineral in a fine state of division.

The constituents were those generally found in meteoric stones of similar appearance. The part soluble in acids consisted chiefly of Silicate of Magnesia and Iron, with interspersed particles of Nickel Iron, and Sulphide of Iron. The part insoluble in acids was also chiefly Silicate of Magnesia and Iron, but with a much larger proportion of Silica.

The analysis of several different portions shewed a certain variety of composition. Thus the insoluble matter varied from 39·5 to 42·6 per cent. of the whole. In the soluble portion, the total amount of Iron varied from 24·7 to 27·7 per cent. in all states. As the particles of Iron differ very considerably in size, it follows that as the proportional quantity of these varies, so must that of the other constituents.

But treatment with acids did not shew the amount of Iron in the free state as distinguished from that in combination. Iodine answered better, but acted partially on the sulphide of Iron as well as on the uncombined metal. Recourse was had to the solvent lately proposed by Meunier, solution of bichloride of Mercury, which dissolves the uncombined metal only: the mercurous chloride produced was removed by a current of chlorine, according to his plan, and metallic mercury by heat; the remaining mineral was then treated by hydrochloric acid, preferably with addition of some nitric acid. From the amount of Iron found in this acid solution, a proportion was deducted as combined with the Sulphur and Phosphorus, the remainder was calculated as oxide. The Sulphide of Iron was taken as  $\text{Fe}_7\text{S}_8$ , Troilite, as contended for by Meunier. The whole of the Nickel is supposed to be in the state of alloy with Iron though probably part exists as Sulphide.

An attempt was made to separate the light-coloured portion of the stone from the dark, so as to compare their composition in the princi-

pal points. The light-coloured portion was got free from the dark, but the dark remained still mixed with a considerable portion of the light-coloured. The differences observed will be pointed out after the results of the general analysis have been given.

A little Phosphorus was found, and is supposed to exist in combination with Iron, 1 eq. to 3 eq. Iron,—Schreibersite.

The results of analysis are as follows :—

Dried at 212° F.

|                                                           |          |       |
|-----------------------------------------------------------|----------|-------|
| Iron,.....                                                | 16·98    | 91·54 |
| Nickel,...                                                | 1·26     | 6·79  |
| Cobalt,.....                                              | ·21      | 1·15  |
| Chromium, .....                                           | ·10      | ·52   |
| Nickel Iron,.....                                         | —— 18·55 | 100·  |
| Iron,.....                                                | 2·69     | 51·54 |
| Sulphur, .....                                            | 1·76     | 33·71 |
| Iron,...                                                  | ·65      | 12·46 |
| Phosphorus, .....                                         | ·12      | 2 29  |
| Troilite and Schreibersite, .....                         | —— 5·22  | 100·  |
| Magnesia,.....                                            | 13·76    | 39·11 |
| Lime, .....                                               | ·68      | 1·93  |
| Soda,.....                                                | ·09      | 26    |
| Protoxide of Iron, .....                                  | 7·51     | 21·35 |
| Alumina, .....                                            | ·41      | 1·17  |
| Silica, .....                                             | 10·73    | 30·50 |
| Loss; removed by Carbonate of Soda with the Silica, ..... | 2·00     | 5·68  |
| Earthy matter soluble in acids, .....                     | —— 35·18 | 100·  |
| Magnesia,.....                                            | 10·04    | 23·70 |
| Lime, .....                                               | 1·69     | 4·00  |
| Soda, with trace of Potash,.....                          | ·78      | 1·84  |
| Protoxide of Iron, .....                                  | 3·65     | 8·62  |
| Oxide of Chromium, .....                                  | ·40      | ·95   |
| Alumina, .....                                            | 1·36     | 3·22  |
| Silica, .....                                             | 24·44    | 57·67 |
| Earthy matter, insoluble in acids,.....                   | —— 42·36 | 100·  |
|                                                           | 101·31   |       |

The earthy matter insoluble in acid is Augitic in character and closely resembles in composition the minerals Tremolite and Actynolite, except that above two-thirds of the Lime in those minerals is replaced in this by Protoxide of Iron. It also contains Chrome Iron to the extent of 1·39 per cent., or ·59 per cent. of the entire stone.

The earthy matter soluble in acids is somewhat similar in composition to Chrysolite or Peridot, but contains a larger proportion of Magnesia and Iron. There is probably a much greater mixture of different minerals than in the case of the insoluble portion.

There is a little Chromium soluble in acid, and also soluble in Iodine, at least partially. I have supposed it to be a constituent of the Nickel Iron alloy.

Several portions which had been treated with acids (in which consequently uncombined Iron could not be estimated) contained in the soluble portion more Silica than is given in the above analysis; about 2 per cent. more. The proportion of matter insoluble in acid in these cases was about 39·5 per cent. of the whole stone.

Attention was directed, as already stated, to the differently coloured portions of the stone. Analysis gave the following results—

|                                         | Light coloured. | Dark coloured,<br>chiefly. |
|-----------------------------------------|-----------------|----------------------------|
| Specific gravity, in small pieces,..... | 3·743           | 3·612                      |
| Ditto ditto again wetted, .....         | 3·763           | 3·704                      |
| Ditto in powder, .....                  | 3·818           | 3·729                      |

Constituents soluble in acids:

|                          |                        |                          |
|--------------------------|------------------------|--------------------------|
| Uncombined Iron, .....   | 17·77                  | 16·20                    |
| Sulphur, .....           | 1·75                   | 1·77                     |
| Magnesia, .....          | 13·65                  | 13·88                    |
| Protoxide of Iron, ..... | 6·67                   | 7·76                     |
| Cobalt,.....             | all, or<br>nearly all. | none, or<br>nearly none. |

The portion insoluble in acids differed little in the two kinds. It will be observed that the principal difference is in the relative proportion of uncombined and oxidised Iron, the dark portion containing most oxide of Iron, the light part containing most uncombined Iron,

and all or almost all the Cobalt. The higher specific gravity of the light-coloured portion accords with the greater quantity of metallic Iron it contains. The state of oxidation of the iron was not experimentally determined, but was assumed to be that of protoxide, in accordance with the analyses given of similar terrestrial minerals. The cause of the difference between the loss of weight sustained by boiling the mineral after the action of acids and the weight of the Silica obtained, appears to depend upon small quantities of other constituents removed by the Carbonate of Soda in solution, or in very fine states of suspension. In one experiment made with great care, the difference of weight was nearly accounted for in this way in Alumina and Oxide of Iron, Lime and Magnesia. In this case, the loss of weight by Carb. of Soda was 12·015 grs., the Silica obtained 11·563 grs., loss only ·452 gr : of the above constituents there was obtained ·315 gr. leaving only unaccounted for ·137 gr. from 100 grs. of the stone.

I have compared its composition with that of other stones, as given in Buchner's Treatise on Meteorites, Liepzig, 1863, and find it bears a pretty close resemblance to that of "Blansko," (Brünner Kreis, Mähren), November, 1833, and that of "Insel Oesel" in Russia, April, 1855, and a still closer one to that of "Klein-wenden" by Nordhausen, Prussia, of September, 1843.

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*A Contribution to our knowledge of Pelagic Mollusca, by Captain  
G. E. FRYER, Madras Staff Corps.*

[Received 10th March, read 2nd June, 1869.]

Having during the last ten years made four voyages round the Cape of Good Hope, and enjoyed some opportunities of studying the habits of *Pteropods*; and understanding that information regarding them, would not be unacceptable to the Bengal Asiatic Society, I have the pleasure to furnish the following particulars. Thinking also that a few directions may be of use to intending collectors, I have appended some information regarding this point at the end of this paper.



*Pteropods* are essentially pelagic animals, rarely found in the neighbourhood of coasts. Some are naked, while others have their bodies enclosed in a shell which, wherever it exists, is exceedingly light and delicate. They are taken singly or in pairs, or in shoals. They vary from the size of a hazel-nut to that of a pin's head. They jerk along the surface of the water by the aid of two muscular appendages, from whose wing-like character the name of the class is derived. They generally rise to the surface after sunset, and disappear with daylight, not as some have supposed for the purpose of breathing, since, for the aeration of their systems, the majority possess a special branchial cavity into which the external water has free access. So regular, however, is their appearance after dark, that D'Orbigny regarded it as the evidence of design.

All observers of *Pteropods* are aware that, although for the most part they are blind,\* their susceptibility of light is very great. When captured and placed alive in a tumbler of sea-water in a dark spot, they protrude their fins, and flap them away vigorously; but no sooner is the light of a lantern turned on them, than they collapse, sink and lie motionless at the bottom.

I suspect then, with M. D'Orbigny, that light controls the movements of these interesting animals. It is probable that as light dawns, each sinks to that depth suited to its individual sensibility, and sustaining itself in the fluid by its own specific gravity; it adjusts its position as light recedes, by instinctively rising until it finds

\* *Clio* excepted.

itself at the surface, easier and more expanded than when compressed in the depths below.\*

Now those learned in matters of hydrography, say that the propagation of light through water is not carried far below the surface. Its influence at the depth of 300 feet is scarcely equal to the glimmer of twilight, and below about 700 feet there is probably perpetual darkness.†

If this be so, may we not assume that the vertical range of those species at least, against whom the letters D. C. N. stand, (see table, p. 269) would be between 1 to 50 fathoms? The following experience regarding three of those species, serves to strengthen this view. On the night of the 2nd of October, 1866, while rowing round Ross Island—the head quarters of the Port Blair settlement at the Andamans,—in an open boat I took to seaward of it *H. quadridentata*, *H. uncinata*, and *H. limbata*. By the charts I find the depth thereabouts varies from 9 to 50 fathoms.

Before referring to the table, I will give one or two extracts from my notes during the outward voyages in 1860 and 1868, which I think may interest the readers of the Journal.

|                   |                                                                    |
|-------------------|--------------------------------------------------------------------|
|                   | 8.30 A. M., one or two <i>Cymbulia</i> , nothing until             |
|                   | 12.30. P. M., two <i>H. tridentata</i> , with number-              |
| 1860. Dec. 7,     | less embryonic forms.                                              |
| S. Lat. 39° 55',  | 1.30. P. M., six <i>H. trid.</i> with <i>Salpæ</i> .               |
| E. Long. 42° 12', | 4.30. P. M. <i>Hydrozooids</i> and <i>Salpæ</i> .                  |
| Therm. 63°,       | 7. P. M. three <i>H. uncinata</i> , medium size.                   |
| Sea 67°,          | 7.30 P. M. Dozens of <i>Sagitta</i> , imbedded in                  |
| Countercurrent.   | myriads of red <i>Entomostraca</i> (Copepods).                     |
|                   | 7.45. P. M. Bag full of red <i>Entomostraca</i> , <i>Sagitta</i> , |
|                   | and two <i>H. uncinata</i> , medium size.                          |
|                   | 8. P. M. Sudden and total disappearance of red                     |
|                   | <i>Entomostraca</i> , succeeded by <i>Salpæ</i> with yellow        |
|                   | nuclei, and some <i>Medusæ</i> , in which were                     |
|                   | imbedded numbers of <i>Balanidium australe</i> .                   |
|                   | 9.30 P. M. Two or three <i>Cleodora pyrami-</i>                    |
|                   | <i>dota</i> of different sizes.                                    |

\* Some species, however, seem quite indifferent to solar influence.

† Petermanns Atlas.

The points of interest in the above entry are threefold :—

First,—the capture of *H. tridentata* (*H. ForskahlII* of D'Orb.) at noon-day, D'Orbigny having recorded it as nocturnal in its habits.

Second,—the appearance in scores of *Balantium australe*. As Cape Horn is its recognized habitat, its presence so far to the eastward was interesting. The Salpian mass in which these animals were imbedded was nearly a foot deep in the bottom of the net.

Third,—that which relates to the red *Entomostraca* : but, as they form a group in a separate class, I will merely say here, that this was the second time they had disappeared suddenly at the same hour, *viz.* when night was closing in. On each occasion, they were followed by small *Salpæ* with yellow nuclei, probably immature forms of *S. maxima* within whose organisms, however, there was no appearance of *Entomostraca*.

1868, June 25,

N. Lat. 5° 42',

W. Long. 22° 42',

Therm. 79°,

Sea, 81°,

Strong current to

N. E.

The net was over from 6 till 10 P. M. At 7.30 P. M. took a solitary specimen of *Cleodora pyramidata*. During the middle watch from 12 to 4 A. M. the Captain's net was in use, and brought up numbers of *Pteropods* and other marine animals.

The next evening the net was again over from 6 to 10.30 P. M. and nothing whatever came up, but three fragmentary Diphyzoooids. Thus on two successive occasions from sunset until 10 P. M., no living thing, except those above named, was brought up, yet during the middle of the night large hauls were made. Within equatorial limits, however, I have generally found the middle watch to be the best time.

The vessel here was in the neighbourhood of strong currents, and they are as we know the consequence of a disturbance in the aqueous equilibrium caused by a high temperature and great evaporating force.\* Can it be that in these latitudes the process of evaporation has anything to do with the vertical movements of these little creatures?

For some days I see it noted that about here the sea was very phosphorescent. It is thought by some that when such is the case, you are unsuccessful with the bag, but I have never found that it makes any difference.

\* Maury.

The table (see p. 269,) accompanying this, has reference merely to those *Pteropods* which are furnished with an external shell; the *Thecosomata* of de Blainville. It shows that the—

|                |             |    |          |
|----------------|-------------|----|----------|
| Atlantic Ocean | contributed | 23 | species. |
| Indian Ocean   | "           | 23 | "        |
| Southern Ocean | "           | 11 | "        |
| Bay of Bengal  | "           | 11 | "        |

It will also be seen that the majority of those species can bear a great difference of temperature, for example *H. uncinata*, *Cl. pyramidata*, *Spirialis rostralis*. On such as these the currents have doubtless a strong diffusive influence, and although the Cape of Good Hope may serve in some measure to isolate the fauna of the Indian Ocean, yet the number of species in the South Atlantic common to it, proves that the two populations do mingle,\* and not only so, but that some of the fauna of the Indian Ocean finds its way up to, and doubtless through the great equatorial current in the Atlantic.†

As far as my own observations go, and from what I have gathered from those of others in the same field, I think the following species are peculiar to that portion of the North Atlantic through which outward ships shape their course—

1. *Hyalæa teniobranchia*,
2. *H. longirostra*,
3. *H. mucronata* (?)
4. *Cleodora balantium*,

also the large coloured variety of *H. gibbosa*, figured by Rang, pl. x, figs. 3 and 4.

To the Indian Ocean, or more properly speaking, the *Indo-Pacific* province‡ I would assign the following species—

1. *Hyalæa flava*,
2. *H. globulosa*,
3. *H. affinis*,
4. *H. tridentata* (?)

\* The drift current of the S. E. trade wind doubtless having much to do with this.

† Woodward.

‡ A bottle thrown overboard  $2\frac{1}{2}$  leagues N. E. of Ascension from the American ship *Lady Montagu* in October 1820, was picked up on the Hanway rocks on the West coast of Guernsey in August, 1821.

Vide p. 155 of the Naut. Mag. for 1854.

5. *Cleodora cuspidata*,
6. *Cuvieria oryza*,
7. *Spirialis trochiformis*,
8. *H. uncinata* (?)

I agree with Rang in thinking that *Cuvieria rosea* is an immature form of *Cuv. collummella*, and I also think *Cuvieria oryza* (Benson) is a still younger form. I have repeatedly taken *Cuv. rosea* and *Cuvieria oryza* with the apex entire, as well as fractured, and of all sizes. The three forms are doubtless one and the same shell.

To the Southern Ocean belong—

1. *Balantium australe*,
2. *B. recurvum* (?)

The remaining seventeen (or fifteen, if we exclude *Cuv. coll.* and *Cuv. rosea*) are common to the Atlantic and Indian Oceans.

As regards their habits the table shows that—

- |    |         |                                     |
|----|---------|-------------------------------------|
| 12 | species | are strictly nocturnal,             |
| 7  | „       | are crepuscular and nocturnal,      |
| 12 | „       | are indifferent to solar influence. |

Observations are, however, not sufficient yet to afford proper explanation of much that relates to the habits and geographical distribution of these interesting little creatures. Time alone can accumulate that number of well-ascertained facts which is much required. There are many intelligent and some enthusiastic workers in Mr. Green's employ, and if men so interested as Captain Edward Jones, and Mr. Salier of the "*Superb*," to whose assistance I am greatly indebted, would from time to time publish the results of their observations, and so stimulate others to varied and continuous experiments, uncertainty regarding these animals would soon be dispelled.

Diagrams were framed, showing the undulations of the temperature of the air, and of the surface temperature of the sea, as registered during two outward voyages round the Cape of Good Hope. On the first occasion, the Cape was rounded during the month of December or at midsummer in that region. On the second, it was passed in June or in the winter season. On both occasions, the observations were made at noon; and as the principal results of these I may, in connexion with the object of this paper mention, that from about the 25th degree of South Latitude to the Equator in the Indian Ocean, the

temperature of the water generally is lower than that of the air. From the 8th degree of North Latitude in West Longitude to the Equator in the Indian Ocean the water is on the contrary warmer than the air.

The direction of the several currents in the table (p. 269) is taken from Beecher's sailing directions for the Atlantic and Indian Oceans.

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NOTE ON *HYALÆA TRIDENTATA*, Lamck.

With regard to this shell, M. Rang in his work on *Pteropods*\* says that it presents two varieties, distinguished by their smaller size; the animal and shell of one being darker in colour, the other having a very clear, and almost transparent yellow colour. To the first of these varieties, he refers *H. affinis* of D'Orbigny, but it is not clear to what he refers the second; however, as he elsewhere objects to Peron's *H. teniobranchia* being regarded as a separate species, the inference is, that he considers it identical with his second variety; although, in truth, it is not distinguished from *H. tridentata* by its smaller size.

In explanation of his text, he gives the following illustrations:

first, *H. Forskahlui*, D'Orb., pl. ii, figs. 1 to 5.

second, *H. tridentata*, Lamck., pl. xii, figs. 1 to 4,  
(figured by Souleyet, both being representations of the same shell; the animals of the first, however, being incorrectly drawn,) and

third, *H. teniobranchia*, Peron,

but no figure is given of the variety he refers to *H. affinis*, D'Orb.

Having been so fortunate as to capture the three shells standing at the head of the list in the table (p. 269), and been able to examine them both in their living and preserved state, I am persuaded that *H. tridentata*, Lamck, *H. teniobranchia*, Peron, and *H. affinis*, D'Orb., represent three separate and distinct species, and I think this will be seen, on referring to plate xxi, where front (1a, 2a, 3a), back (1b, 2b, 3b), and side (1c, 2c, 3c) views of them are shown.†

In their front aspect, that is to say, with the ventral plate uppermost

\* Hist. Nat. des Pteropodes, 1852. MM. Rang and Souleyet.

† Figs. 2 and 3, plate xxi, are copied from drawings from nature by Dr. Ramsay Stewart, R. A., a fellow passenger on board the *Superb* to whom my best thanks are due.

figs. 1a, 2a, 3a, the contour of the first is semi-spherical, the second subtriangular, the third somewhat of an elongated oval.

Viewed inferiorly, figs. 1b, 2b, 3b, the sculpture of the dorsal plate in each, presents the following peculiarities.—

In *H. tridentata*, there are five longitudinal ribs, and, as Mr. Benson very accurately observes “the edges of the lateral rifts are expanded and very thin, and on the flatter side\* are wrinkled at right angles to the line of the rift and slightly reflected at the edge.”†

In *H. teniobranchia* three longitudinal ribs converge separately, and narrowing as they approach the terminal tooth, unite above it. At the lateral points the edge of the ventral plate overlaps the dorsal; at the shoulders the dorsal plate overlaps the ventral.

In *H. affinis*, three longitudinal ribs unite in the upper half of the dorsal plate and thence descend to the terminal tooth in one more or less well defined prominent rib.

The side view shows the degree of convexity in the ventral plate of each shell.

In figures, 1,‡ 2,§ 3, we see differences also in the animals. In fig. 1, the alar appendages are rectangular and trilobated at their external edge; In fig. 3 they are oval; In fig. 2, they are of intermediate shape.

The lateral expansions of the mantle, in *H. tridentata* and *H. affinis*, are both broad and short. In the latter they are yellowish towards the extremity and dark brown at the tips; the buccal mass too is of a dark brown colour. In *H. teniobranchia* on the other hand, the mantle processes are filiform, in length about two inches, extremities yellow, with dark brown tips.

As Dr. J. E. Gray in his catalogue|| has given no description of *H. teniobranchia*, and only a brief one of *H. tridentata*, I append a description of each, recasting the one given by him of *H. affinis* and adding his synonyms of *H. tridentata*.

\* *i. e.* dorsal.

† Mr. Benson's notes on *Hyalæa*, Vol. 7. Ann. Mag. Nat. Hist. 3rd Series, No. 37.

‡ After Souleyet.

§ After Peron and Lesueur.

|| Catalogue of *Pteropoda* in the British Museum, London, 1850.

**Hyalæa tridentata**, GMEL. Pl. xxi, Fig. 1.

*Anomia tridentata*, Gmelin ; Forskahlîi, Chemnitz ; Chiaje.

*Cavolina natans*, Abilgaard ; Cuvier.

*Caulina natans*, Poli.

*Hyalæa papilionacea*, Bory de St. Vincent ; Blainville.

*Hyalæa cornea*, Roissi, Lamck.

*Hyalæa tridentata*, Bosc ; Lamck. ; D'Orbigny ; Philippi.

*Hyalæa Chemnitziana*, Peron et Lesueur.

*Hyalæa Forskahlîi*, Les. : D'Orbigny.

*Hyalæa tridentée*, Voyage Bonite, Moll.

*Hyalæa truncata* Krauss.

Shell semi-spherical, inflated, gibbous anteriorly, lateral points somewhat convergent, widely cleft, lateral margin of dorsal plate wrinkled, slightly reflected, inferiorly five-ribbed, terminal tooth longer than the lateral ones.

*Habitat.* Indian and Pacific (?) Oceans.

**Hyalæa teniobranchia**, PERON, Pl. xxi, Fig. 2.

*Hyalæa Peronii*, Rang.

Shell sub-triangular, flat, semi-transparent ; lateral points wide, somewhat divergent ; upper third of cleft overlapped by margin of dorsal plate, lower third overlapped by ventral margin ; inferiorly, three ribs converge separately and narrowing unite towards the long terminal tooth.

*Habitat.* North Atlantic.

**Hyalæa affinis**, d'ORB., Pl. xx ; Fig. 3.

*Hyalæa affinis*, Desh. in Lamck. Hist.

(?) *Hyalæa Peronii*, Les.

Shell ovoid, inflated, transparent, horny ; inferior lip very long, narrow, sinuated superiorly ; inferiorly three ribs unite in anterior half of dorsal plate, and thence descend posteriorly in one more or less prominent rib.

*Habitat.* Indian and Pacific Oceans.

*Directions for collecting.*

As my towing net was similar to that used by Mr. McGillivray, I give his description. It "consisted of bag of bunting (used for flags) two feet deep, the mouth of which was sewn round a wooden hoop 14 inches in diameter; three pieces of cord, a foot and a half long, were secured to the hoop at equal intervals, and had their ends tied together. When in use the net was towed astern, clear of the ship's wake, by a stout cord secured to one of the quarter boats, or held in the hand. The scope of the line required was regulated by the speed of the vessel at the time, and the amount of strain caused by the partially submerged net."\*

I have tried all kinds of material for nets, and have used iron hoops also, but there is nothing like a red bunting bag of conical shape attached to a wooden hoop. The woollen texture of bunting retains so little water, that when hauled up, the sides of the bag do not stick together, as is the case with muslin or "gunny," and as there is less strain when a wooden hoop is used, there is less mutilation in the contents of the bag, and the most delicate forms may be procured in a perfect state of preservation. It may be three feet deep, with so much of the bottom, or apex of the cone, cut off as to freely admit the fingers inside. I have always preferred the lee side of the ship, as the water is generally smoothed. The following articles are very necessary, a dark lantern with supply of oil, a good thermometer, a three power pocket magnifying lens; 4 thin plain glass tumblers without any pattern on them provided with a stand;† as the breadth of bunting is narrow, I should say 10 yards; a few rolls of cleating cords; a couple of thimbles for the *grey* line or *in haul*, and two quarts of methylated spirit. As regards open-mouthed glass-stoppered bottles, I should recommend three dozen one ounce bottles in a case, filled with methylated spirit and water, half and half; one dozen four-ounce bottles; with some larger ones also. After every haul which, when the animals are plentiful, should take place every ten or fifteen minutes,‡ carefully pick out all the Pteropods—

\* Voyage of H. M. S. "*Rattlesnake*," Vol. I. p. 27.

† They are sold at Osler's at one rupee a piece, of the shape of a frustum of a cone.

‡ The bag should be carefully watched and manœuvred, or else it will become filled with every description of filth from the vessel.

naked, as well as shelled ones,—and place them by themselves in a tumbler of fresh sea water, as they accumulate there again by species, taking care to keep the water free from shrimps, fish and crustacea which soon destroy its purity. After that invert and shake the bag into a basin of water the inside of which should be painted white; as this fills, pour off the floating refuse, preserving the sediment which, on straining the next morning through a pocket handkerchief, will be found to consist of minute *Atlantæ*, some species of *Spirialis*, embryonic univalves of all kinds &c. The little animals die soon after capture. After 24 hours maceration, the retractor muscle will relax sufficiently to allow of their bodies being picked out of the shells with a needle or a pair of delicate forceps, and all that is wanted for them then is cotton wool and pill boxes of sizes.

To those ignorant of the names of these animals, the simplest method would be to put the result of the day's work into one or more of the one-ounce glass-stoppered bottles filled with methylated spirit and water, half and half; number the bottles, and let the numbers be entered on the chart opposite the proper date. The bottles should also bear on a label the following information: the hour and date of capture; the ship's position at noon; the temperature of the air and surface; temperature of the sea, and the name and direction of the current.

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[Species, relating which any additional information has been published, are printed in *Italics*, and new genera and species are marked with an asterisk].

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# ERRATA IN PART II, OF VOL. XXXVIII.

Page,	line,	for,	read,
2	10	Bog	Boga.
4	13	portions	position.
5	18	being sided	sides.
8	22	Lúmdellor	Lúmdekorh.
9	25-26	they so vary	so even.
24	21	;	omit.
16	20	Purjonkla, clearing the strata &c.	Poronkla Clearing; the strata &c.
"	21	and belonging	belong.
20	27	is another stream	is reached, and another &c.
26	20	to	from
"	27	Asbik river	Ashek-river.
32	32	<i>instructis</i>	<i>instructo.</i>
79	3	pedalia	pedales.
121	16	vitrifolius	vitifolius.
147	11	S.	P.
149	5	<i>fragraus</i>	<i>fragrans.</i>
167	15	but	for.
"	„ (at end of line) for	but	but
168	28	Conystes	Coccyestes.
"	31	Tacconia	Taccocua.
179	12	Cyp. Abyssinicus	Cyp. affinis.
173	30	but	best.
176	1	<i>pennis</i>	<i>plumis.</i>
"	34	the parts	the lower parts.
177	18	<i>Malacolmi</i>	<i>Malcolmi.</i>
"	22	paler	pale.
"	27	sonalis	socialis.
178	36	<i>Janthia</i>	<i>Ianthia.</i>
179	12	cyanotus	cyanota.
180	12	<i>atragularis</i>	<i>atrogularis.</i>
192	8	T.	V.
199	5	præ-nasal	pre-anal.
"	6	post-nasal	post-anal.
204	22	<i>Peel</i>	Peal.
229	20	Peelianus	Pealianus.
231	11	A. C. Peel	S. E. Peal.
251	10	<i>Peelianus</i>	Pealianus.
263	6	collummella	columnella.
267	27	grey	guy.
289 in the last column		<i>H. Chaptula</i>	<i>Cl. Chaptalii.</i>

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January 1869.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	30.073	30.154	30.026	0.128	64.4	74.0	56.7	17.3
2	.106	.182	.061	.121	65.7	75.4	57.5	17.9
3	.119	.184	.068	.116	68.1	76.0	60.6	15.4
4	.103	.196	.022	.174	70.5	76.3	64.2	12.1
5	.032	.103	29.969	.134	70.7	78.0	66.2	11.8
6	.104	.183	30.054	.129	66.8	76.2	58.6	17.6
7	.115	.191	.059	.132	67.0	76.2	59.0	17.2
8	.096	.186	.028	.158	65.9	74.5	58.6	15.9
9	.092	.175	.044	.131	66.3	75.0	59.0	16.0
10	.106	.178	.052	.126	65.3	75.4	56.3	19.1
11	.117	.212	.068	.144	66.7	76.9	58.5	18.4
12	.112	.197	.049	.148	67.7	78.0	58.9	19.1
13	.089	.161	.041	.120	69.7	79.0	61.0	18.0
14	.123	.190	.063	.127	72.5	80.0	66.8	13.2
15	.195	.294	.134	.160	69.7	78.0	62.0	16.0
16	.130	.220	.066	.154	67.3	77.0	58.5	18.5
17	.078	.159	.007	.152	67.2	76.5	59.2	17.3
18	.044	.119	29.985	.134	68.0	76.9	59.7	17.2
19	.058	.148	30.009	.139	67.9	77.2	60.2	17.0
20	.081	.168	.019	.149	68.6	78.8	59.5	19.3
21	.052	.160	29.965	.195	70.3	81.2	61.0	20.2
22	29.983	.074	.919	.155	72.2	82.4	64.6	17.8
23	.924	29.998	.871	.127	73.8	83.3	67.2	16.1
24	.922	.987	.864	.123	74.9	85.8	68.5	17.3
25	.967	30.057	.918	.139	72.7	80.5	66.0	14.5
26	.985	.062	.935	.127	72.4	80.5	65.2	15.3
27	30.000	.066	.942	.124	74.1	80.2	69.0	11.2
28	.009	.081	.963	.118	69.3	72.0	67.5	4.5
29	29.945	.015	.880	.135	72.2	80.8	65.0	15.8
30	.942	.114	.900	.114	73.9	80.0	70.0	10.0
31	.965	.045	.901	.144	73.9	80.6	69.5	11.1

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during he day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	57.5	6.9	51.3	13.1	0.390	4.34	2.40	0.64
2	59.9	5.8	55.3	10.4	.447	.97	.05	.71
3	64.7	3.4	62.0	6.1	.559	6.18	1.37	.82
4	65.3	5.2	61.1	9.4	.543	5.97	2.16	.73
5	65.6	5.1	61.5	9.2	.550	6.05	.13	.74
6	60.4	6.4	55.3	11.5	.447	4.95	.31	.68
7	59.6	7.4	53.7	13.3	.423	.69	.61	.64
8	59.6	6.3	54.6	11.3	.437	.85	.21	.69
9	59.4	6.9	53.9	12.4	.426	.73	.42	.66
10	58.0	7.3	52.2	13.1	.402	.47	.46	.65
11	59.5	7.2	53.7	13.0	.423	.69	.54	.65
12	61.3	6.4	56.2	11.5	.461	5.08	.38	.68
13	64.5	5.2	60.3	9.4	.528	.82	.11	.73
14	67.0	5.5	62.6	9.9	.570	6.24	.39	.72
15	60.6	9.1	53.3	16.4	.418	4.61	3.32	.58
16	58.4	8.9	51.3	16.0	.390	.32	.05	.59
17	59.0	8.2	52.4	14.8	.405	.48	2.87	.61
18	60.0	8.0	53.6	14.4	.422	.67	.86	.62
19	59.9	8.0	53.5	14.4	.421	.66	.85	.62
20	61.4	7.2	55.6	13.0	.452	.99	.68	.65
21	65.2	5.1	61.1	9.2	.543	5.97	.11	.74
22	66.2	6.0	61.4	10.8	.548	6.00	.55	.70
23	67.4	6.4	62.9	10.9	.576	.29	.69	.70
24	68.5	6.4	64.0	10.9	.597	.50	.78	.70
25	65.6	7.1	59.9	12.8	.521	5.70	.98	.66
26	66.5	5.9	61.8	10.6	.555	6.07	.53	.71
27	68.7	5.4	64.9	9.2	.615	.73	.32	.74
28	67.2	2.1	65.5	3.8	.628	.92	0.91	.88
29	68.7	3.5	65.9	6.3	.636	.98	1.57	.82
30	68.9	5.0	65.4	8.5	.626	.82	2.19	.76
31	70.2	3.5	67.7	6.0	.674	7.37	1.59	.82

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
Mid- night.	30.057	30.185	29.931	0.254	66.2	72.0	59.4	12.6
1	.049	.186	.930	.256	65.5	71.8	58.5	13.3
2	.040	.185	.921	.264	65.0	71.4	58.0	13.4
3	.032	.179	.910	.269	64.4	71.0	58.5	12.5
4	.028	.178	.894	.284	63.9	71.0	58.2	12.8
5	.037	.190	.906	.284	63.4	71.5	57.7	13.8
6	.052	.204	.915	.289	62.8	70.6	57.0	13.6
7	.073	.221	.939	.282	62.5	70.0	56.3	13.7
8	.099	.253	.957	.296	63.5	70.5	58.2	12.3
9	.124	.285	.978	.307	66.6	72.0	62.2	9.8
10	.133	.294	.987	.307	70.1	75.0	66.0	9.0
11	.114	.276	.971	.305	73.4	77.2	68.5	8.7
Noon.	.084	.232	.934	.298	75.4	80.7	69.0	11.7
1	.050	.196	.909	.287	76.7	83.5	70.0	13.5
2	.022	.166	.886	.280	77.6	84.5	70.9	13.6
3	.005	.148	.871	.277	78.0	85.8	71.5	14.3
4	29.998	.134	.864	.270	77.3	85.1	72.0	13.1
5	30.005	.140	.868	.272	76.1	83.0	71.5	11.5
6	.014	.145	.878	.267	73.7	79.3	68.3	11.0
7	.030	.154	.895	.259	71.8	77.2	66.5	10.7
8	.050	.172	.913	.259	70.4	76.9	64.6	12.3
9	.063	.183	.934	.249	69.1	75.0	63.8	11.2
10	.069	.187	.939	.248	68.1	74.0	62.5	11.5
11	.063	.182	.933	.249	67.2	73.0	61.5	11.5

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid- night.	62.2	4.0	59.0	7.2	0.506	5.61	1.51	0.79
1	61.8	3.7	58.8	6.7	.503	.57	.41	.80
2	61.4	3.6	58.5	6.5	.498	.52	.35	.80
3	61.2	3.2	58.3	6.1	.494	.49	.25	.82
4	60.9	3.0	58.2	5.7	.493	.48	.15	.83
5	60.5	2.9	57.9	5.5	.488	.42	.11	.83
6	60.0	2.8	57.5	5.3	.481	.38	.03	.84
7	59.7	2.8	57.2	5.3	.476	.32	.03	.84
8	60.4	3.1	57.6	5.9	.483	.37	.18	.82
9	62.1	4.5	58.5	8.1	.498	.51	.70	.76
10	63.8	6.3	58.8	11.3	.503	.53	2.50	.69
11	64.8	8.6	57.9	15.5	.488	.31	3.56	.60
Noon.	65.4	10.0	58.4	17.0	.496	.39	4.04	.57
1	65.7	11.0	58.0	18.7	.489	.30	.50	.54
2	66.3	11.3	58.4	19.2	.496	.37	.70	.53
3	66.1	11.9	57.8	20.2	.486	.26	.93	.52
4	65.8	11.5	57.7	19.6	.485	.24	.74	.53
5	65.9	10.2	58.8	17.3	.503	.46	.17	.57
6	65.9	7.8	60.4	13.3	.530	.80	3.16	.65
7	65.5	6.3	60.5	11.3	.532	.84	2.61	.69
8	64.7	5.7	60.1	10.3	.525	.77	.33	.71
9	64.1	5.0	60.1	9.0	.525	.78	.00	.74
10	63.6	4.5	60.0	8.1	.523	.78	1.77	.77
11	63.0	4.2	59.6	7.6	.516	.71	.64	.78

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
1	115.2	...	E. & W. S. W.	...	40.4	Clear. Slightly foggy from midnight to 2 A. M., & from 6 to 11 P. M.
2	111.5	...	S.W. & variable.	...	29.2	Clear. Slightly foggy from 4 to 8 A. M., & from 8 to 11 P. M.
3	112.0	...	S.S. W. & S. S. E.	...	37.0	Clear to 5 A. M., scatd. \i & \i afterwards. Foggy from midnight to 8 A. M. Light rain at 11½ P. M.
4	120.0	...	Variable.	...	49.3	\i to 4 A. M., \i to 5 P. M., clear afterwards.
5	110.6	...	S. by E. & N. W.	...	56.7	\i to 5 A. M., stratoni to 11 A. M., \i to 4 P. M., clear afterwards. Slightly foggy at 8 & 9 A. M.
6	111.2	...	E.N.E.&N.N.W.	...	16.6	Clear. Slightly foggy at 9 P.M.
7	116.2	...	N.N.E.&N.byE	...	169.7	Clear. Foggy from 7 to 11 P.M.
8	114.8	...	N.E. & S.S. W.	...	57.0	Clear. Slightly foggy from 7 to 10 P. M.
9	113.4	...	WNW & W by S.	...	40.0	Clear. Foggy at 9 & 10 P. M.
10	111.0	...	E.N. E & variable	...	45.5	Chiefly clear. Slightly foggy from 7 to 11 P. M. Two sharp shocks of earthquake were felt at 4 h. 43½ P. M.
11	117.4	...	S. S. E.	...	42.4	Clear to 6 A. M., scatd. \i to 6 P. M., clear afterwards. Foggy from 7 to 9 P. M.
12	109.5	...	S. S. E. & S. E.	...	18.7	Clear to 6 A. M., scatd. \i to 5 P.M., clear afterwards. Slightly foggy at 8 & 9 P. M.
13	113.2	...	S. byE& S. S.E	...	62.1	Chiefly clear.
14	113.5	...	S. W. & N.	...	50.0	Scatd. \i to 4 P. M., clear afterwards.
15	116.5	...	NNE,& N. by W.	0.4	158.7	Clear.
16	114.0	...	N.W. & N. by E.	...	151.3	Clear.
17	116.0	...	W, N. W. & NW.	...	106.2	Clear.
18	115.5	...	W.N. W. & S.W.	...	99.9	Clear to 1 P. M., scatd. \i afterwards.
19	112.5	...	SW,WNW&WS. [W.	...	49.7	Clear to 10 A. M., scatd. \i to 6 P. M., clear afterwards. Slightly foggy at 7 A. M.
20	111.5	...	S. S. W. & W.	...	41.3	Clear.
21	119.4	...	S by W. & S.S.W.	...	54.6	Clear. Foggy from 1 to 8 A.M.
22	118.6	...	S S. W. & S by W	...	157.3	Chiefly clear.
23	121.0	...	SbyW,SW&SSW	...	168.6	Clear.
24	120.8	...	S.S.W, S. W. & S.	...	158.8	Clear to 3 P. M., scatd. \i afterwards.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1 ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
25	112.0	...	E.N.E. & E by N.	1.5	202.6	Scatd. \i to 2 A. M., clear to 5 A. M., \i afterwards.
26	111.5	...	E.byN.& variable.	...	99.0	Clear to 5 A. M., scatd. \i to 10 A. M., \i afterwards.
27	119.0	...	SbyE,N&variable	...	65.8	\i to 3 A. M., straton to 8 A M. Scatd. \i to 6 P. M., straton afterwards. Thunder at 11 P. M.
28	...	0.78	SS. E. & variable.	...	111.4	Overcast to 2 P.M., scatd. \i afterwards. Thunder & Lightning at midnight. Foggy at 8 P. M. Rain at midnight & light rain from 5½ to 11 A. M. & at 9 P. M.
29	122.5	...	SSE.& S. W.	...	83.3	Chiefly scatd. \i.
30	120.4	0.12	SSW,NE.&ENE.	...	135.0	\i to 6 P.M., clear afterwards. Rain at 3½ A. M.
31	121.4	...	S. S. E. & S. W.	...	62.3	Clear to 4 A. M., straton to 11 A. M., \i to 5 P. M., clear afterwards. Foggy from 2 to 10 A. M.

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, \i Cumulo strati, \i Nimbi  
 \i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of January 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	30.054
Max. height of the Barometer occurred at 10 A. M. on the 15th.	30.294
Min. height of the Barometer occurred at 4 P. M. on the 24th.	29.864
<i>Extreme range</i> of the Barometer during the month	0.430
Mean of the daily Max. Pressures	30.134
Ditto ditto Min. ditto	29.996
<i>Mean daily range</i> of the Barometer during the month	0.138

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	°
Mean Dry Bulb Thermometer for the month	69.5
Max. Temperature occurred at 3 P. M. on the 24th.	85.8
Min. Temperature occurred at 7 A. M. on the 10th	56.3
<i>Extreme range</i> of the Temperature during the month	29.5
Mean of the daily Max. Temperature	78.1
Ditto ditto Min. ditto	62.4
<i>Mean daily range</i> of the Temperature during the month	15.7

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Mean Wet Bulb Thermometer for the month	63.4
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.1
Computed Mean Dew-point for the month	58.5
Mean Dry Bulb Thermometer above computed mean Dew-point	11.0

	Inches.
Mean Elastic force of Vapour for the month	0.498

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	Troy grain.
Mean Weight of Vapour for the month	5.48
Additional Weight of Vapour required for complete saturation	2.40
Mean degree of humidity for the month, complete saturation being unity	0.70

Mean Max. Solar radiation Temperature for the month.	115.4
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	Inches.
Rained 3 days,—Max. fall of rain during 24 hours	0.78
Total amount of rain during the month	0.90
Total amount of rain indicated by the Gauge attached to the anemometer during the month	0.80
Prevailing direction of the Wind... S. W., S. S. W. & S. S. E.	

*Abstract of the Results of the Hourly Meteorological Observations taken at the Surveyor General's Office, Calcutta, in the month of Jan'y. 1869.*

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

Hour.	N.	Rain on.	N. by E.	Rain on.	N. N. E.	Rain on.	N. E.	Rain on.	E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	No. of days	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February 1869.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.877	29.971	29.792	0.179	76.2	82.7	71.5	11.2
2	.772	.863	.692	.171	76.2	83.0	71.3	11.7
3	.819	.909	.734	.166	73.6	80.6	68.4	12.2
4	.954	30.044	.874	.170	70.5	77.8	64.5	13.3
5	.998	.090	.932	.158	69.4	77.5	61.0	16.5
6	.914	.000	.833	.167	71.5	82.1	61.0	21.1
7	.891	29.962	.815	.147	67.0	72.6	62.9	9.6
8	.982	30.051	.944	.107	67.0	75.2	59.0	16.2
9	.992	.037	.945	.092	62.1	67.0	60.0	7.0
10	.996	.053	.941	.112	61.3	64.7	59.2	5.5
11	30.049	.133	30.000	.133	65.2	74.5	57.5	17.0
12	.017	.098	29.961	.137	67.4	76.2	59.5	16.7
13	29.999	.071	.944	.127	70.5	79.5	62.5	17.0
14	30.013	.084	.959	.125	72.2	81.6	65.2	16.4
15	29.991	.076	.935	.141	73.4	82.2	66.5	15.7
16	.948	.013	.881	.132	75.3	83.7	69.0	14.7
17	.983	.060	.914	.146	76.9	85.0	71.2	13.8
18	30.033	.126	.984	.142	76.9	84.0	71.5	12.5
19	29.972	.065	.886	.179	75.4	84.8	69.0	15.8
20	.953	.027	.886	.141	77.7	86.5	71.4	15.1
21	.933	29.989	.881	.108	78.6	89.0	71.9	17.1
22	.930	30.003	.869	.134	79.1	90.0	70.0	20.0
23	.918	29.981	.868	.113	79.5	90.0	71.5	18.5
24	.969	30.043	.910	.133	80.0	90.0	72.0	18.0
25	.994	.081	.933	.148	81.0	91.5	73.0	18.5
26	.958	.036	.898	.138	79.7	90.5	72.0	18.5
27	.972	.034	.930	.104	78.6	87.4	71.0	16.4
28	.984	.048	.928	.120	76.5	82.0	72.5	9.5

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	°	°	°	°	Inches.	T. gr.	T. gr.	
1	73.3	2.9	71.3	4.9	0.758	8.25	1.41	0.85
2	69.9	6.3	65.5	10.7	.628	6.83	2.83	.71
3	63.8	9.8	56.9	16.7	.472	5.14	3.79	.58
4	59.4	11.1	50.5	20.0	.380	4.18	.95	.51
5	58.7	10.7	50.1	19.3	.375	.13	.73	.53
6	64.1	7.4	58.2	13.3	.493	5.41	2.97	.65
7	62.9	4.1	59.6	7.4	.516	.72	1.58	.78
8	60.7	6.3	55.7	11.3	.453	.02	2.28	.69
9	60.0	2.1	58.1	4.0	.491	.49	0.78	.88
10	59.9	1.4	58.6	2.7	.499	.59	.53	.91
11	61.1	4.1	57.8	7.4	.486	.40	1.51	.78
12	61.9	5.5	57.5	9.9	.481	.32	2.07	.72
13	65.1	5.4	60.8	9.7	.537	.90	.23	.73
14	67.6	4.6	63.9	8.3	.595	6.52	.03	.76
15	66.0	7.4	60.1	13.3	.525	5.74	3.13	.65
16	70.6	4.7	67.3	8.0	.666	7.25	2.15	.77
17	72.3	4.6	69.1	7.8	.706	.66	.20	.78
18	71.9	5.0	68.4	8.5	.690	.48	.38	.76
19	70.0	5.4	66.2	9.2	.642	6.99	.44	.74
20	72.6	5.1	69.0	8.7	.704	7.62	.48	.75
21	71.4	7.2	66.4	12.2	.646	.00	3.38	.67
22	70.9	8.2	65.2	13.9	.621	6.72	.81	.64
23	72.9	6.6	68.3	11.2	.688	7.43	.23	.70
24	71.7	8.3	65.9	14.1	.636	6.86	.95	.64
25	70.1	10.9	62.0	19.0	.559	.01	5.13	.54
26	69.5	10.2	62.4	17.3	.567	.11	4.61	.57
27	71.4	7.2	66.4	12.2	.646	7.00	3.38	.67
28	70.1	6.4	65.6	10.9	.630	6.85	2.90	.70

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fah.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
Mid- night.	29.962	30.041	29.759	0.282	70.6	76.8	60.2	16.6
1	.951	.036	.750	.286	70.0	76.0	59.8	16.2
2	.942	.033	.745	.288	69.5	75.2	59.2	16.0
3	.933	.028	.734	.294	68.8	74.3	58.8	15.5
4	.926	.030	.752	.278	68.3	74.5	58.5	16.0
5	.937	.037	.767	.270	67.8	73.0	57.8	15.2
6	.954	.053	.781	.272	67.5	73.5	57.5	16.0
7	.976	.068	.798	.270	67.4	73.3	57.5	15.8
8	30.000	.091	.820	.271	68.5	75.0	58.0	17.0
9	.023	.119	.850	.269	70.9	79.2	59.5	19.7
10	.031	.133	.863	.270	73.7	84.0	59.5	24.5
11	.020	.124	.843	.281	76.2	86.5	60.5	26.0
Noon.	29.994	.094	.816	.278	78.2	87.7	60.5	27.2
1	.964	.058	.773	.285	79.7	89.5	60.5	29.0
2	.936	.030	.734	.296	80.7	91.4	60.3	31.1
3	.917	.010	.705	.305	81.4	91.5	60.0	31.5
4	.907	.000	.698	.302	81.2	91.5	60.0	31.5
5	.908	.005	.692	.313	80.3	90.0	60.5	29.5
6	.919	.029	.697	.332	78.1	86.5	61.0	25.5
7	.929	.019	.715	.304	75.7	83.4	60.5	23.9
8	.948	.037	.739	.298	74.2	81.0	60.2	20.8
9	.964	.046	.760	.286	72.9	79.2	60.5	18.7
10	.974	.060	.771	.289	71.8	78.2	60.4	17.8
11	.970	.053	.761	.292	71.1	77.4	60.4	17.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid- night.	67.3	3.3	64.7	5.9	0.611	6.72	1.43	0.83
1	67.0	3.0	64.6	5.4	.609	.71	.29	.84
2	66.5	3.0	64.1	5.4	.599	.60	.28	.84
3	66.1	2.7	63.9	4.9	.595	.56	.15	.85
4	65.6	2.7	63.4	4.9	.586	.46	.14	.85
5	65.2	2.6	63.1	4.7	.580	.41	.07	.86
6	64.9	2.6	62.8	4.7	.574	.35	.07	.83
7	64.8	2.6	62.7	4.7	.572	.33	.06	.86
8	65.6	2.9	63.3	5.2	.584	.44	.21	.84
9	65.4	4.5	62.8	8.1	.574	.31	.92	.77
10	67.3	6.4	62.8	10.9	.574	.27	2.69	.70
11	67.7	8.5	61.7	14.5	.554	.00	3.63	.62
Noon.	63.0	10.2	60.9	17.3	.539	5.83	4.42	.57
1	68.3	11.4	60.3	19.4	.523	.70	5.02	.53
2	68.4	12.3	59.8	20.9	.520	.50	.45	.51
3	68.3	13.1	59.1	22.3	.508	.46	.81	.48
4	68.0	13.2	58.8	22.4	.503	.40	.81	.43
5	63.5	11.8	60.2	20.1	.527	.67	.24	.52
6	63.9	9.2	62.5	15.6	.563	6.15	4.07	.60
7	63.3	7.4	63.1	12.6	.580	.30	3.21	.66
8	63.1	6.1	63.8	10.4	.593	.48	2.61	.71
9	67.6	5.3	63.4	9.5	.583	.40	.33	.73
10	67.3	4.5	63.7	8.1	.591	.48	1.97	.77
11	67.2	3.9	64.1	7.0	.599	.53	.70	.80

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
1	...	0.04	S. S. W.	...	90.9	Stratoni to 11 A. M., scatd. ☉ to 6 P. M., clear afterwards. Slightly foggy from 2 to 7 A. M. Rain at 11½ A. M.
2	123.0	...	S. S. W. & W. by S.	0.2	147.6	Scuds from S. W., to 7 A. M. clear to 7 P. M., scatd. ☉ afterwards.
3	119.0	...	NNW. & variable.	0.3	135.7	Chiefly clear.
4	116.5	...	W. S. W., N. W. & NNW.	0.4	129.0	Clear.
5	120.0	...	S. S. E. & S. S. W.	...	108.0	Clear. Slightly foggy at 8 & 9 P. M.
6	120.3	...	S. S. E.	0.4	96.3	Clear to 1 A. M., ☉ afterwards. Lightning from 7 to 11 P. M.
7	108.0	0.12	N. N. W. & N. E.	1.9	212.9	Overcast to 1 P. M., clear afterwards. Lightning from midnight to 2 A. M. Thunder at 2 A. M. Rain at 2½ A. M.
8	113.0	...	N. N. W. & E. N. E.	0.2	99.4	Clear to 1 P. M., stratoni afterwards.
9	...	1.93	E. & N. E.	...	119.2	☉ & ☉ to 7 A. M., overcast afterwards. Rain from 7¼ A. M. to 11 P. M.
10	...	0.63	N. E. & E. N. E	...	183.8	Overcast to 6 P. M., clear afterwards. Thunder at 1 & 2 A. M. Slightly foggy at 11 P. M. Rain from midnight to noon.
11	113.0	...	E. N. E. & N.	...	50.0	Chiefly clear. Foggy at 7. & 8. A. M. & from 9 to 11 P. M.
12	120.5	...	N. by W. & W. S. W.	...	58.4	Clear. Slightly foggy from midnight to 3 A. M. & at 8 & 9 P. M.
13	117.8	...	S. W. & S. S. W.	...	75.0	Clear.
14	120.0	...	S. S. W. & S. W.	...	112.7	Chiefly clear. Foggy from 6 to 9 A. M. & at 8 & 9 P. M.
15	122.0	...	W, WNW & W by S	...	86.3	Clear to 2 P. M., stratoni to 8 A. M., clear afterwards. Foggy from midnight to 2 & from 6 to 8 A. M.
16	128.0	...	S. S. W.	...	108.0	Clear to 6 A. M., stratoni to 9 A. M., scatd. ☉ to 4 P. M., clear afterwards. Foggy from 3 to 7 A. M.
17	126.6	...	S. S. W, S. W. & E.	...	131.0	Clear to 4 A. M., stratoni to 9 A. M., scatd. ☉ to 3 P. M., clear afterwards. Foggy from 7 to 9 P. M.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches	W. by S.	lb	Miles	
18	129.0	...	S.S.W, W.N.W. &	...	62.0	Clear to 10 A. M., ☾i to 5 P. M., clear afterwards.
19	126.6	...	W. S. W. & S. W.	...	82.3	Clear to 6 A. M., straton to 10 A. M., clear afterwards. Foggy at 7 & 8 A. M. & at 11 P. M.
20	124.0	...	S. S. W. & S. W.	1.0	116.7	Stratoni to 9 A. M., clear afterwards. Foggy from 5 to 8 A. M.
21	126.6	...	S. by W, S. W. & S.	0.8	130.5	Chiefly clear
22	123.0	...	S. S. W. & W. by S.	...	285.8	Clear
23	121.0	...	S. S. W. & S. W.	...	94.0	Clear
24	125.5	...	S. & N. N. E.	...	109.6	Clear to 2 P. M., scatd. \i afterwards. Foggy at 7 & 8 P. M.
25	131.5	...	N. W. & W. S. W.	...	89.4	\i to 4 A. M., scatd \i afterwards.
26	128.5	...	S. S. W.	...	125.3	Chiefly scatd. \i
27	129.0	...	S. W. & S. S. W.	...	101.7	Chiefly scatd. \i
28	...	...	S W. & W. N. W.	...	78.6	Clouds of different kinds.

\i Cirri, — i Strati, ☾i Cumuli, \i Cirro-strati, ~i Cumulo strati, ~i Nimbi  
 \i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of February 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.958
Max. height of the Barometer occurred at 10 A. M. on the 11th.	30.133
Min. height of the Barometer occurred at 5 P. M. on the 2nd.	29.692
Extreme range of the Barometer during the month	0.441
Mean of the daily Max. Pressures	30.034
Ditto ditto Min. ditto	29.895
Mean daily range of the Barometer during the month	0.139

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	°
Mean Dry Bulb Thermometer for the month	73.5
Max. Temperature occurred at 3 & 4 P. M. on the 25th.	91.5
Min. Temperature occurred at 6 & 7 A. M. on the 11th	57.5
Extreme range of the Temperature during the month	34.0
Mean of the daily Max. Temperature	81.8
Ditto ditto Min. ditto	67.0
Mean daily range of the Temperature during the month	14.8

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Mean Wet Bulb Thermometer for the month	67.1
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.4
Computed Mean Dew-point for the month	62.6
Mean Dry Bulb Thermometer above computed mean Dew-point	10.9

Inches.

Mean Elastic force of Vapour for the month	0.570
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Troy grain.

Mean Weight of Vapour for the month	6.23
Additional Weight of Vapour required for complete saturation	2.67
Mean degree of humidity for the month, complete saturation being unity	0.70

°

Mean Max. Solar radiation Thermometer for the month.	122.2
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Inches.

Rained 4 days,—Max. fall of rain during 24 hours	1.93
Total amount of rain during the month	2.72
Total amount of rain indicated by the Gauge attached to the anemometer during the month	2.53
Prevailing direction of the Wind...	S. S. W., & S. W.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

[illegible]

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1869.*

Latitude  $22^{\circ} 33' 1''$  North. Longitude  $88^{\circ} 20' 34''$  East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at $32^{\circ}$ Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Temperature during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.932	30.016	29.862	0.154	77.9	86.8	71.5	15.3
2	.867	29.933	.808	.125	79.8	88.3	73.6	14.7
3	.863	.931	.797	.134	86.5	89.5	74.0	15.5
4	.904	.966	.834	.132	77.9	81.5	76.0	5.5
5	.925	.987	.865	.122	79.8	86.5	74.4	12.1
6	.913	30.030	.815	.215	75.4	84.5	68.8	15.7
7	.900	29.997	.826	.171	73.5	79.5	68.0	11.5
8	.868	.941	.814	.127	75.7	83.0	68.6	14.4
9	.904	.987	.841	.146	78.7	86.8	71.6	15.2
10	.934	30.092	.843	.249	73.2	76.5	65.8	10.7
11	.883	29.966	.819	.147	75.5	83.5	68.0	15.5
12	.870	.960	.809	.151	78.6	87.7	71.4	16.3
13	.848	.925	.783	.142	80.4	88.5	74.3	14.2
14	.821	.889	.756	.133	81.9	89.8	76.0	13.8
15	.807	.865	.749	.116	83.4	92.7	76.8	15.9
16	.874	.952	.834	.118	82.8	89.7	78.0	11.7
17	.855	.926	.800	.126	84.0	93.4	76.8	16.6
18	.844	.921	.797	.124	81.7	87.9	76.5	11.4
19	.803	.875	.731	.144	81.0	92.5	74.5	18.0
20	.806	.890	.749	.141	80.5	89.4	73.6	15.8
21	.825	.892	.770	.122	77.9	85.6	73.7	11.9
22	.877	.955	.812	.143	78.0	87.5	69.0	18.5
23	.883	.971	.812	.159	78.3	87.4	70.4	17.0
24	.878	.954	.806	.148	82.3	90.5	75.4	15.1
25	.852	.944	.790	.154	81.6	89.5	75.5	14.0
26	.841	.926	.775	.151	84.1	92.3	76.9	15.4
27	.848	.939	.774	.165	83.9	93.8	76.5	17.3
28	.892	.963	.828	.135	82.6	91.4	75.5	17.9
29	.893	.960	.839	.121	83.6	92.0	76.0	16.0
30	.886	.949	.818	.131	82.8	92.0	75.0	17.0
31	.897	.974	.849	.125	84.4	94.5	74.7	19.8

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	73.2	4.7	69.9	8.0	.0725	7.85	2.31	0.77
2	70.8	9.0	64.5	15.3	.607	6.56	4.19	.61
3	76.3	4.2	73.4	7.1	.811	8.75	2.23	.80
4	74.9	3.0	72.8	5.1	.795	.62	1.54	.85
5	75.6	4.2	72.7	7.1	.792	.56	2.19	.80
6	71.3	4.1	68.4	7.0	.690	7.51	1.92	.80
7	69.3	4.2	66.4	7.1	.646	.07	.83	.79
8	70.4	5.3	66.7	9.0	.653	.10	2.41	.75
9	73.2	5.5	69.3	9.4	.711	.69	.72	.74
10	70.5	2.7	68.3	4.9	.688	.52	1.30	.85
11	69.6	5.9	65.5	10.0	.628	6.84	2.62	.72
12	73.6	5.0	70.1	8.5	.729	7.89	.49	.76
13	76.4	4.0	73.6	6.8	.817	8.80	.14	.80
14	75.5	6.4	71.0	10.9	.751	.07	3.37	.71
15	77.2	6.2	72.9	10.5	.797	.54	.42	.71
16	76.0	6.8	71.2	11.6	.756	.10	.65	.69
17	75.2	8.8	69.0	15.0	.704	7.53	4.64	.62
18	71.7	10.0	64.7	17.0	.611	6.57	.80	.58
19	70.9	10.1	63.8	17.2	.593	.39	.75	.57
20	71.1	9.4	64.5	16.0	.607	.54	.44	.60
21	72.2	5.7	68.2	9.7	.686	7.43	2.73	.73
22	71.7	6.3	67.3	10.7	.666	.21	.98	.71
23	73.5	4.8	70.1	8.2	.729	.90	.38	.77
24	76.5	5.8	72.4	9.9	.785	8.43	3.15	.73
25	75.8	5.8	71.7	9.9	.768	.26	.08	.73
26	74.7	9.4	68.1	16.0	.684	7.31	4.90	.60
27	74.4	9.5	67.7	16.2	.674	.22	.91	.60
28	73.7	8.9	67.5	15.1	.670	.20	.48	.62
29	73.0	10.6	65.6	18.0	.630	6.75	5.28	.56
30	71.7	11.0	63.9	18.9	.595	.38	.37	.54
31	73.5	10.9	65.9	18.5	.636	.79	.52	.55

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
Mid- night.	29.879	29.979	29.801	0.178	76.4	81.0	68.0	13.0
1	.867	.960	.795	.165	76.0	80.3	69.0	11.3
2	.855	.954	.786	.168	75.6	79.5	68.8	10.7
3	.847	.950	.780	.170	75.2	78.8	68.8	10.0
4	.841	.943	.773	.170	74.6	78.6	68.9	9.7
5	.850	.947	.783	.164	74.2	78.4	68.5	9.9
6	.869	.953	.797	.156	74.0	78.0	68.5	9.5
7	.892	.979	.825	.154	74.3	78.0	68.0	10.0
8	.921	.993	.858	.135	76.3	80.6	70.5	10.1
9	.942	30.092	.865	.227	78.6	84.5	65.8	18.7
10	.946	.045	.865	.180	81.0	87.0	66.4	20.6
11	.934	.016	.851	.165	83.2	90.0	66.5	23.5
Noon.	.914	.011	.820	.191	84.8	92.2	70.5	21.7
1	.886	29.963	.809	.154	86.1	92.5	72.3	20.2
2	.857	.940	.785	.155	86.9	93.6	73.6	20.0
3	.832	.885	.761	.124	87.2	94.3	75.0	19.3
4	.817	.878	.731	.147	87.4	94.5	76.5	18.0
5	.813	.889	.738	.151	86.7	93.9	75.5	18.4
6	.817	.898	.741	.157	84.5	90.3	74.5	15.8
7	.830	.909	.750	.159	82.3	87.2	73.5	13.7
8	.852	.936	.761	.175	80.9	86.0	73.5	12.5
9	.874	.943	.785	.158	79.3	84.0	73.0	11.0
10	.883	30.000	.805	.195	78.3	82.6	73.2	9.4
11	.884	.030	.802	.228	77.4	81.8	68.8	13.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point,	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	°	°	°	°	Inches.	T. gr.	T. gr.	
Mid- night.	72.6	3.8	69.9	6.5	0.725	7.87	1.85	0.81
1	72.5	3.5	70.0	6.0	.727	.90	.70	.82
2	72.2	3.4	69.8	5.8	.722	.85	.63	.83
3	72.0	3.2	69.8	5.4	.722	.87	.50	.84
4	72.0	2.6	70.2	4.4	.732	.99	.21	.87
5	71.8	2.4	70.1	4.1	.729	.97	.12	.88
6	71.7	2.3	70.1	3.9	.729	.97	.07	.88
7	72.1	2.2	70.6	3.7	.741	8.08	.04	.89
8	73.0	3.3	70.7	5.6	.744	.08	.61	.83
9	73.3	5.3	69.6	9.0	.717	7.76	2.62	.75
10	73.6	7.4	68.4	12.6	.690	.42	3.72	.67
11	74.0	9.2	67.6	15.6	.672	.20	4.69	.61
Noon.	74.1	10.7	66.6	18.2	.651	6.95	5.51	.56
1	74.2	11.9	65.9	20.2	.636	.78	6.17	.52
2	74.1	12.8	66.4	20.5	.646	.87	.38	.52
3	74.2	13.0	66.4	20.8	.646	.87	.50	.51
4	74.4	13.0	66.6	20.8	.651	.91	.54	.51
5	74.4	12.3	67.0	19.7	.659	7.01	.17	.53
6	74.7	9.8	67.8	16.7	.677	.23	5.12	.59
7	74.5	7.8	69.0	13.3	.704	.56	4.02	.65
8	74.1	6.8	69.3	11.6	.711	.64	3.46	.69
9	73.6	5.7	69.6	9.7	.717	.74	2.85	.73
10	73.3	5.0	69.8	8.5	.722	.81	.47	.76
11	73.1	4.3	70.1	7.3	.729	.92	.09	.79

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches	[S. by W.	lb	Miles	
1	120.0	...	S. S. W, W. S. W. &	...	106.5	Clear to 2 A. M., \i to 7 A. M., ° clear to 1 P. M., \i to 6 P. M., clear afterwards.
2	125.0	...	S. S. W. & S. W.	...	150.2	Chiefly clear.
3	127.0	...	S. by W.	...	88.6	Clear to 2 A. M., scuds to 9 A. M., \i to 7 P. M., clear afterwards. Foggy at 6 A. M. Lightning at 11 P. M.
4	...	0.04	Variable.	7.0	212.0	Clouds of different kinds to 11 A. M., straton to 7 P. M., clear afterwards. High wind at 11¼ A. M. Thunder at 4 & 5 A. M. Lightning at 4, 5 & 11 A. M. & at 7 P. M. Light rain at 4 & 11¼ A. M.
5	120.4	...	S. & S. S. W.	2.0	118.3	Clouds of different kinds to 8 A. M. \i to 6 P. M. \i after wards. Brisk wind at 11½ P. M. Thunder at 11 P. M. Lightning at 10 & 11 P. M.
6	121.5	1.19	Variable.	20.0	116.5	Chiefly straton. Storm at 10 P. M. Thunder at midnight & 1 A. M. & at 10 & 11 P. M. Lightning at midnight, & 1 A. M. & from 9 to 11 P. M. Rain at midnight & at 10 & 11 P. M.
7	117.5	...	S. E. & variable.	0.4	182.4	Straton to 6 A. M. \i to 6 P. M. clear afterwards.
8	123.5	...	S. E. & S.	6.0	116.5	\i to 5 A. M. \i to 11 A. M. \i to 2 P. M., \i to 6 P. M. clear afterwards. High wind at 0 h. 20 m. Thunder & drizzled at midnight. Lightning to S at 4 & 5 A. M.
9	126.5	...	S. & N.	...	85.0	Chiefly clear & \i.
10	110.0	1.04	S. S. E. & variable	10.0	138.4	Clear to 4 A. M., straton to 8 A. M., overcast to 11 A. M., clouds of different kinds afterwards. High wind from 8¼ to 10 A. M. Foggy at 7 & 8 A. M. Thunder & Lightning at 8 & 9 A. M. & at 8 P. M. Rain from 8½ to 11 A. M. & at 1½ & 8½ P. M.
11	125.0	...	[& S. S. W. N. N. E., W. S. W.	...	95.7	\i to 10 A. M., clear afterwards.
12	131.0	...	S. by W. & S. S. W.	0.3	136.2	Clear to 9 A. M., \i to 4 P. M. \i 7 to P. M., clear afterwards.
13	127.8	...	S. S. W.	0.2	150.8	Clear to 4 A. M., \i & \i afterwards. Slightly foggy at 4 & 5 A. M.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	o	Inches		lb	Miles	
14	131.0	...	S. W.	...	159.9	Clear to 5 A. M. \i & \i to 6 P. M., clear afterwards.
15	129.0	...	S. S. W. & S. W.	...	88.3	Stratoni to 7 A. M. \i to 6 P. M., clear afterwards. Foggy at 6 A. M.
16	126.0	...	S. W.	...	109.7	\i to 4 A. M., stratoni to 2 P. M., \i to 6 P. M., clear afterwards.
17	130.0	...	S. W.	...	93.4	Clear to 6 A. M., \i afterwards.
18	125.5	...	S. W. & S. S. W.	...	100.6	Clear to 5 A. M., stratoni afterwards.
19	131.0	...	S. & variable.	4.7	93.5	Clear to 5 A. M. \i to 9 A. M. \i afterwards. Brisk wind from 1¼ to 2¾ P. M.
20	127.5	...	W.S.W.&variable	...	162.3	Stratoni to 6 A. M. \i to 6 P. M., clear afterwards.
21	119.5	...	S.S.W.& variable.	3.1	104.3	Clear to 5 A. M. \i to 11 A. M., stratoni to 3 P. M. \i afterwards. Brisk wind from noon to 3¼ P.M. Light rain at 4 & 5½ P.M.
22	129.0	2.32	Variable	23.0	180.0	\i to noon \i to 6 P. M., \i afterwards. Storm from 8¼ to 9½ P. M. Thunder at 8 & 9 P. M. Lightning at midnight & from 7 to 10 P. M. Rain at 9 & 10 P. M.
23	129.0	...	S. by W. & W. S. W.	...	121.8	Clear to 10 A. M. \i to 4 P. M. clear afterwards.
24	131.5	...	[S.W. S.W, W. S. W. & S.	...	93.4	Clear to 3 A. M., clouds of different kinds afterwards. Foggy at 6 & 7 A. M.
25	130.5	...	S. W, & S. S. W.	...	157.4	\i to 5 A. M. \i to 3 P. M., clear afterwards. Drizzled at 4 A. M.
26	130.0	...	S. S. W. & S. W.	...	118.9	Chiefly clear.
27	130.2	...	S. W. & W. S. W.	8.5	87.2	Clear to 4 P. M., clouds of different kinds afterwards High wind from 8¼ to 8½ P. M. Thunder at 9 P. M. Lightning at 8 & 9 P. M. Drizzled at 9 & 10 P. M.
28	129.0	...	S. & variable.	...	205.2	\i to 5 A.M., clear afterwards
29	130.0	...	N. by W. & S. S. E.	...	97.6	Clear to 5 A. M., clouds of different kinds afterwards.
30	131.0	...	S. W.	3.3	97.3	Stratoni to 7 A. M., \i & \i to 11 A. M., clear afterwards. Brisk wind from 2 to 2½ A. M.
31	135.0	...	S. W. & S. S. W.	...	126.5	Clear.

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, \i Cumulo strati, \i Nimbi  
 \i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of March 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.871
Max. height of the Barometer occurred at 9 A. M. on the 10th.	30.092
Min. height of the Barometer occurred at 4 P. M. on the 19th.	29.731
<i>Extreme range</i> of the Barometer during the month	0.361
Mean of the daily Max. Pressures	29.951
Ditto ditto Min. ditto	29.807
<i>Mean daily range</i> of the Barometer during the month	0.144

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	°
Mean Dry Bulb Thermometer for the month	80.1
Max. Temperature occurred at 4 P. M. on the 31st.	94.5
Min. Temperature occurred at 9 A. M. on the 10th	65.8
<i>Extreme range</i> of the Temperature during the month	28.7
Mean of the daily Max. Temperature	88.2
Ditto ditto Min. ditto	73.4
<i>Mean daily range</i> of the Temperature during the month...	14.8

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Mean Wet Bulb Thermometer for the month	73.3
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.8
Computed Mean Dew-point for the month	68.5
Mean Dry Bulb Thermometer above computed mean Dew-point	11.6

	Inches.
Mean Elastic force of Vapour for the month	0.692

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	Troy grain.
Mean Weight of Vapour for the month	7.47
Additional Weight of Vapour required for complete saturation	3.37
Mean degree of humidity for the month, complete saturation being unity	0.69

	°
Mean Max. Solar radiation Thermometer for the month.	126.7

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	Inches.
Rained 8 days,—Max. fall of rain during 24 hours	2.32
Total amount of rain during the month	4.59
Total amount of rain indicated by the Gauge attached to the anemometer during the month	3.45
Prevailing direction of the Wind... S. W., & S. S. W.	



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1869.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.888	29.968	29.821	0.147	85.7	95.5	77.5	18.0
2	.845	.942	.762	.180	85.8	95.5	79.0	16.5
3	.805	.875	.753	.122	86.6	96.8	77.5	19.3
4	.836	.910	.787	.123	86.7	96.5	77.9	18.6
5	.828	.924	.745	.179	87.1	98.0	76.6	21.4
6	.746	.836	.655	.181	88.2	99.5	79.0	20.5
7	.710	.806	.625	.181	87.1	95.5	80.1	15.4
8	.680	.743	.607	.136	87.2	98.1	79.0	19.1
9	.703	.766	.656	.110	85.6	93.0	80.0	13.0
10	.792	.909	.701	.208	84.8	92.5	79.5	13.0
11	.819	.914	.756	.158	84.9	95.2	79.0	16.2
12	.816	.891	.750	.141	85.4	95.4	77.5	17.9
13	.786	.850	.711	.139	85.6	93.8	79.5	14.3
14	.724	.797	.641	.156	85.3	92.0	80.8	11.2
15	.673	.767	.566	.201	85.6	91.0	82.6	8.4
16	.664	.742	.530	.212	83.6	91.8	75.0	16.8
17	.677	.734	.630	.104	87.3	96.3	81.5	14.8
18	.714	.782	.643	.139	87.7	95.6	82.5	13.1
19	.730	.799	.655	.144	86.2	91.5	80.6	10.9
20	.769	.830	.718	.112	86.2	92.2	82.0	10.2
21	.814	.884	.743	.141	86.5	93.3	81.5	11.8
22	.796	.877	.681	.196	86.6	93.3	81.7	11.6
23	.704	.771	.608	.163	87.2	94.8	81.5	13.3
24	.664	.739	.578	.161	87.3	95.4	81.4	14.0
25	.722	.851	.652	.199	87.1	94.0	76.5	17.5
26	.762	.820	.704	.116	86.7	96.4	77.0	19.4
27	.744	.814	.660	.154	87.6	97.5	81.7	15.8
28	.725	.805	.659	.146	87.1	98.5	79.0	19.5
29	.751	.812	.677	.135	87.7	97.5	80.5	17.0
30	.796	.860	.725	.135	88.5	98.2	80.3	17.9

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	75.3	10.4	63.0	17.7	0.681	7.26	5.54	0.57
2	74.8	11.0	67.1	18.7	.661	.04	.79	.55
3	74.7	11.9	67.6	19.0	.672	.16	.98	.55
4	73.6	13.1	65.7	21.0	.632	6.73	6.45	.51
5	74.5	12.6	66.9	20.2	.657	.99	.34	.52
6	76.6	11.6	69.6	18.6	.717	7.60	1.6	.55
7	75.2	11.9	68.1	19.0	.684	.26	.07	.55
8	79.2	8.0	74.4	12.8	.838	8.91	4.46	.67
9	79.4	6.2	75.1	10.5	.857	9.13	3.63	.72
10	75.4	9.4	68.8	16.0	.699	7.46	5.00	.60
11	76.0	8.9	69.8	15.1	.722	.71	4.78	.62
12	75.8	9.6	69.1	16.3	.706	.53	5.15	.59
13	79.6	6.0	75.4	10.2	.865	9.24	3.52	.72
14	79.4	5.9	75.3	10.0	.862	.21	.43	.73
15	79.4	6.2	75.1	10.5	.857	.13	.63	.72
16	78.5	5.1	74.9	8.7	.851	.11	2.92	.76
17	80.7	6.6	76.7	10.6	.902	.58	3.83	.71
18	81.3	6.4	77.5	10.2	.925	.84	.72	.73
19	80.6	5.6	76.7	9.5	.902	.60	.39	.74
20	80.5	5.7	76.5	9.7	.896	.56	.43	.74
21	80.6	5.9	77.1	9.4	.913	.74	.36	.74
22	80.7	5.9	77.2	9.4	.916	.77	.37	.74
23	81.2	6.0	77.6	9.6	.928	.87	.50	.74
24	81.8	5.5	78.5	8.8	.955	10.16	.25	.76
25	81.0	6.1	77.3	9.8	.919	9.78	.55	.73
26	80.5	6.2	76.8	9.9	.905	.63	.55	.73
27	79.7	7.9	75.0	12.6	.854	.07	4.45	.67
28	78.0	9.1	72.5	14.6	.787	8.37	.96	.63
29	79.7	8.0	74.9	12.8	.851	9.04	.52	.67
30	80.0	8.5	74.9	13.6	.851	.02	.86	.65

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
Mid- night.	29.764	29.900	29.664	0.236	82.4	84.2	77.0	7.2
1	.753	.890	.653	.237	81.8	84.0	76.0	8.0
2	.743	.883	.646	.237	81.3	83.6	75.5	8.1
3	.734	.871	.640	.231	80.9	83.6	75.0	8.6
4	.934	.874	.639	.235	80.5	83.5	75.6	7.9
5	.749	.889	.656	.233	80.3	83.5	75.6	7.9
6	.769	.904	.681	.223	80.2	84.0	76.6	7.4
7	.793	.932	.697	.235	81.1	84.5	77.5	7.0
8	.814	.950	.717	.233	83.4	86.6	79.5	7.1
9	.827	.968	.726	.242	86.0	88.5	79.0	9.5
10	.828	.967	.734	.233	88.5	91.0	82.0	9.0
11	.819	.958	.721	.237	90.9	93.6	85.4	8.2
Noon.	.797	.932	.704	.228	92.5	95.8	88.2	7.6
1	.768	.910	.669	.241	93.8	97.7	90.4	7.3
2	.737	.872	.645	.227	94.6	99.4	91.0	8.4
3	.709	.857	.617	.240	94.8	99.5	90.4	9.1
4	.693	.842	.592	.250	94.2	99.5	88.8	10.7
5	.686	.839	.530	.309	92.7	99.0	86.7	12.3
6	.691	.821	.534	.287	90.3	97.4	85.5	11.9
7	.713	.830	.588	.242	87.6	92.5	84.4	8.1
8	.734	.837	.620	.217	86.0	91.0	83.7	7.3
9	.755	.862	.631	.231	84.8	88.5	82.7	5.8
10	.770	.871	.645	.226	83.7	87.0	79.0	8.0
11	.768	.864	.645	.219	83.1	85.6	76.5	9.1

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	°	°	°	°	Inches.	T. gr.	T. gr.	
Mid- night.	78.5	3.9	75.8	6.6	0.876	9.41	2.20	0.81
1	78.2	3.6	75.7	6.1	.873	.40	.00	.83
2	78.0	3.3	75.7	5.6	.873	.40	1.84	.84
3	77.9	3.0	75.8	5.1	.876	.44	.66	.85
4	77.8	2.7	75.9	4.6	.879	.47	.51	.86
5	77.6	2.7	75.7	4.6	.873	.41	.50	.86
6	77.6	2.6	75.8	4.4	.876	.46	.42	.87
7	77.9	3.2	75.7	5.4	.873	.41	.76	.84
8	78.4	5.0	74.9	8.5	.851	.11	2.85	.76
9	78.8	7.2	73.8	12.2	.822	8.76	4.15	.68
10	78.9	9.6	73.1	15.4	.803	.53	5.35	.62
11	78.8	12.1	71.5	19.4	.763	.06	6.83	.54
Noon.	78.8	13.7	70.6	21.9	.741	7.79	7.80	.50
1	78.9	14.9	70.0	23.8	.727	.62	8.56	.47
2	79.0	15.6	69.6	25.0	.717	.51	9.00	.46
3	78.8	16.0	69.2	25.6	.708	.41	.24	.45
4	78.8	15.4	69.6	24.6	.717	.51	8.85	.46
5	78.6	14.1	70.1	22.6	.729	.66	.02	.49
6	78.7	11.6	71.7	18.6	.768	8.11	6.52	.55
7	78.6	9.0	73.2	14.4	.806	.57	4.95	.63
8	78.5	7.5	73.2	12.8	.806	.59	.32	.67
9	78.6	6.2	74.3	10.5	.835	.92	3.54	.72
10	78.4	5.3	74.7	9.0	.846	9.06	.01	.75
11	78.6	4.5	75.4	7.7	.865	.28	2.58	.78

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure.	Daily Velocity.	
	°	Inches		lb	Miles	
1	131.6	...	S. S. W. & S. W.	...	157.2	Clear.
2	134.0	...	S. W. & S. S. W.	0.6	126.1	Chiefly clear. Thunder at 7½ A. M. Slight rain at 8 A. M.
3	135.5	...	S. W. & S. S. W.	...	115.6	Clear.
4	133.0	...	S. S. W. & S. W.	...	69.0	Clear.
5	135.0	...	S. W.	...	107.2	Clear.
6	135.0	...	S. W.	...	127.3	Clear.
7	127.4	...	S. S. W.	...	126.3	Clear to 5 A. M., $\searrow$ i to 10 A. M., stratonito to 5 P. M., clear afterwards.
8	130.0	...	S. W. & S.	0.4	123.5	Chiefly clear.
9	130.0	...	S. & S. S. W.	0.2	180.3	$\searrow$ i to 6 P. M., clear afterwards.
10	129.5	...	S. S. W. & variable	1.0	240.4	Clear to 5 A. M., $\searrow$ i to 10 A. M., clear to 2 P. M., $\searrow$ i to 7 P. M., clear afterwards. Drizzled at 4 P. M.
11	128.5	...	S. W. & S. S. W.	3.5	166.9	Clear to 6 A. M., clouds of different kinds to 6 P. M., clear afterwards. Brisk wind from 8½ to 9½ A. M. Drizzled at 9 A. M.
12	135.5	...	S. W. & S. S. W.	...	125.1	Clear to noon, stratonito to 7 P. M., clear afterwards.
13	130.0	...	S. S. W. & S.	1.1	154.0	$\searrow$ i to 4 P. M., clear afterwards.
14	124.0	...	S. S. W.	2.8	303.8	Clear to 6 A. M., $\searrow$ i to 6 P. M., stratonito afterwards. Brisk wind from 7½ A. M. to 10½ P. M. Lightning to N. at 8 P. M.
15	124.0	...	S. S. W. & S. S. E.	11.0	396.2	Chiefly stratonito. High wind from 8 A. M. to 11 P. M. Thunder at 7 P. M. Lightning at 7 & 8 P. M. Drizzled at 6½ A. M.
16	129.8	0.08	S. S. E. & S. S. W.	19.0	480.5	Stratonito to 9 A. M., $\searrow$ i to 3 P. M., overcast afterwards. Strong wind from 8½ A. M. to 11 P. M. Thunder at 5 P. M. Lightning at 8 & 9 P. M. Rain at 6½ P. M.
17	135.4	...	S. W. & S. S. W.	2.6	328.1	Clear to 7 P. M. Stratonito afterwards. Brisk wind from 1¼ to 11 P. M.
18	131.4	...	S. S. W., S. W. & S.	1.8	446.6	Stratonito to 7 A. M., $\searrow$ i to 3 P. M., scuds afterwards. Brisk wind from 7½ to 10 A. M. & from 7½ to 11 P. M.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
19	128.3	...	S.S.W. & S by W.	4.1	379.8	Scuds to 9 A. M. ☾ to 3 P. M., scuds to 8 P. M., strati afterwards. Brisk wind from 7½ A. M. to 8½ P. M.
20	126.8	...	S. & S. S. W.	1.5	350.6	Strati to 11 A. M., ☾ to 8 P. M., clear afterwards. Brisk wind from 8 to 9½ A. M.
21	131.4	...	S. by W. & SSW.	1.0	269.2	Clear to 2 A. M., scuds to 9 A. M., ☾ to 4 P. M., scuds afterwards. Brisk wind from 9¼ A. M. to 1¼ P. M.
22	136.0	...	S. S. W. & S. W.	1.8	265.6	Clear to 6 A. M., scuds to 11 A. M., clear to 5 P. M., strati afterwards. Brisk wind from 1 to 4½ P. M. Thunder at 7 P. M. Lightning at 7 & 8 P. M. Drizzled at 7½ P. M.
23	129.0	...	S.S.W, S.W. & S.	2.6	340.0	Strati to 3 A. M., clear afterwards. Brisk wind from 8¼ to 12½ A. M.
24	129.2	...	S.byW, S.S.W & S.	3.2	369.4	Clear to 3 A. M., ☾ to 10 A. M., clear to 8 P. M., † scuds afterwards. Brisk wind from 7½ A. M. to 1¼ P. M.
25	130.7	0.12	S. & S. by E.	7.0	321.9	Chiefly ☾. High wind. Thunder & rain at 10 P. M.
26	134.0	...	S. by W. & S.	...	225.6	Clouds of different kinds.
27	134.8	...	S.byE., S.byW & S	...	151.7	☾ to 5 A. M., strati to 10 A. M., ☾ to 5 P. M., clear afterwards.
28	134.0	...	S. by W. & S.S.W.	3.5	139.1	Clouds of different kinds. Brisk wind from 5 to 5½ P. M. Thunder at 6 P. M.
29	137.0	...	S.by W. & S.S.W.	...	124.5	Chiefly ☾.
30	137.5	...	S.S.W. & S.E.	...	90.7	Clear to 3 P. M., ☾ to 7 P. M., clear afterwards.

☾ i Cirri, — i Strati, ☾ i Cumuli, ☾ i Cirro-strati, ☾ i Cumulo strati, ☾ i Nimbi  
☾ i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of April 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.756
Max. height of the Barometer occurred at 9 A. M. on the 1st.	22.968
Min. height of the Barometer occurred at 5 P. M. on the 16th.	29.530
<i>Extreme range</i> of the Barometer during the month	0.438
Mean of the daily Max. Pressures	29.834
Ditto ditto Min. ditto	29.680
<i>Mean daily range</i> of the Barometer during the month	0.154

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	°
Mean Dry Bulb Thermometer for the month	86.5
Max. Temperature occurred at 3 & 4 P. M. on the 6th.	99.5
Min. Temperature occurred at 3 A. M. on the 16th	75.0
<i>Extreme range</i> of the Temperature during the month	24.5
Mean of the daily Max. Temperature	95.2
Ditto ditto Min. ditto,	79.6
<i>Mean daily range</i> of the Temperature during the month	15.6

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Mean Wet Bulb Thermometer for the month	78.5
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	8.0
Computed Mean Dew-point for the month	73.7
Mean Dry Bulb Thermometer above computed mean Dew-point	12.8

	Inches.
Mean Elastic force of Vapour for the month	0.819

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	Troy grain.
Mean Weight of Vapour for the month	8.73
Additional Weight of Vapour required for complete saturation	4.37
Mean degree of humidity for the month, complete saturation being unity	0.67

	°
Mean Max. Solar radiation Thermometer for the month.	131.6

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	Inches.
Rained 7 days,—Max. fall of rain during 24 hours	0.12
Total amount of rain during the month	0.20
Total amount of rain indicated by the Gauge attached to the anemometer during the month	0.11
Prevailing direction of the Wind...	S. S. W., & S. W.



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1869.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.796	29.859	29.733	0.126	85.9	92.0	81.0	11.0
2	.836	.918	.772	.146	87.6	97.0	80.0	17.0
3	.825	.911	.721	.190	86.4	95.1	75.5	19.6
4	.736	.805	.663	.142	84.6	92.7	76.3	16.4
5	.755	.810	.677	.133	85.8	94.5	76.9	17.6
6	.777	.847	.723	.124	87.5	95.0	76.6	18.4
7	.779	.890	.708	.182	86.3	95.5	77.2	18.3
8	.729	.798	.641	.157	88.7	98.0	82.0	16.0
9	.674	.726	.611	.115	88.7	96.0	83.0	13.0
10	.665	.723	.616	.107	88.8	96.0	83.0	13.0
11	.671	.720	.619	.101	89.8	98.7	84.0	14.7
12	.668	.729	.586	.143	89.7	100.0	83.5	16.5
13	.685	.765	.617	.148	89.6	99.0	82.0	17.0
14	.737	.808	.645	.163	89.4	97.4	82.3	15.1
15	.678	.779	.572	.207	89.3	97.3	82.5	14.8
16	.486	.614	.317	.297	80.1	86.8	75.9	10.9
17	.603	.666	.465	.201	82.6	93.5	77.5	16.0
18	.599	.659	.534	.125	85.8	91.7	77.7	14.0
19	.536	.590	.458	.132	87.5	92.2	84.5	7.7
20	.591	.643	.548	.095	88.0	93.6	84.5	9.1
21	.595	.708	.492	.216	86.8	94.0	76.4	17.6
22	.594	.674	.511	.163	81.4	89.2	75.5	13.7
23	.594	.662	.522	.140	86.0	93.0	79.0	14.0
24	.627	.690	.519	.171	85.6	93.0	79.0	14.0
25	.625	.694	.563	.131	86.3	94.0	79.0	15.0
26	.629	.725	.535	.190	87.1	94.3	80.6	13.7
27	.659	.714	.596	.118	87.6	94.0	80.6	13.4
28	.634	.689	.555	.134	88.5	95.0	83.5	11.5
29	.555	.637	.453	.184	87.7	96.1	77.5	18.6
30	.552	.623	.475	.148	88.4	96.0	82.8	13.2
31	.626	.715	.572	.143	88.5	95.0	84.0	11.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	°	°	°	°	Inches.	T. gr.	T. gr.	
1	79.7	6.2	75.4	10.5	0.865	9.22	3.65	0.72
2	79.6	8.0	74.8	12.8	.849	.02	4.50	.67
3	79.2	7.2	74.2	12.2	.832	8.87	.19	.68
4	77.7	6.9	72.9	11.7	.797	.52	3.87	.69
5	78.9	6.9	74.1	11.7	.830	.85	.98	.69
6	80.9	6.6	76.9	10.6	.908	9.64	8.5	.72
7	78.3	8.0	72.7	13.6	.792	8.44	4.58	.65
8	82.0	6.7	78.0	10.7	.940	9.97	3.99	.71
9	83.0	5.7	79.6	9.1	.989	10.50	.46	.75
10	82.6	6.2	78.9	9.9	.967	.26	.74	.73
11	82.8	7.0	78.6	11.2	.958	.15	4.27	.70
12	82.6	7.1	78.3	11.4	.949	.05	.32	.70
13	82.1	7.5	77.6	12.0	.923	9.83	.50	.69
14	81.4	8.0	76.6	12.8	.899	.52	.73	.67
15	80.8	8.5	75.7	13.6	.873	.24	.97	.65
16	76.5	3.6	74.0	6.1	.827	8.93	1.91	.82
17	76.6	6.0	72.4	10.2	.785	.43	3.25	.72
18	82.2	3.6	79.7	6.1	.992	10.59	2.24	.83
19	83.1	4.4	80.5	7.0	1.017	.83	.66	.80
20	83.5	4.5	80.8	7.2	.027	.92	.76	.80
21	82.2	4.6	79.4	7.4	0.983	.47	.74	.79
22	76.7	4.7	73.4	8.0	.811	8.73	.54	.78
23	80.1	5.9	76.0	10.0	.882	9.41	3.50	.73
24	80.3	5.3	76.6	9.0	.899	.59	.17	.75
25	80.9	5.4	77.1	9.2	.913	.74	.28	.75
26	81.0	6.1	77.3	9.8	.919	.78	.55	.73
27	81.5	6.1	77.8	9.8	.934	.93	.59	.73
28	82.2	6.3	78.4	10.1	.952	10.10	.78	.73
29	81.8	5.9	78.3	9.4	.949	.09	.47	.74
30	82.9	5.5	79.6	8.8	.989	.50	.34	.76
31	82.4	6.1	78.7	9.8	.961	.20	.68	.74

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
Mid- night.	29.672	29.905	29.465	0.440	82.7	86.8	76.3	10.5
1	.656	.871	.485	.386	82.6	86.3	77.0	9.3
2	.645	.838	.476	.362	82.4	85.4	76.2	9.2
3	.640	.807	.475	.332	82.2	84.5	75.6	8.9
4	.643	.816	.521	.295	82.1	84.7	75.5	9.2
5	.657	.843	.533	.310	82.0	85.0	76.0	9.0
6	.673	.859	.532	.327	82.2	85.2	76.0	9.2
7	.696	.877	.563	.314	83.5	86.0	76.6	9.4
8	.715	.890	.582	.308	85.7	88.3	77.5	10.8
9	.721	.911	.587	.324	87.9	90.5	78.6	11.9
10	.721	.889	.590	.299	89.8	93.0	80.4	12.6
11	.712	.871	.561	.310	91.4	96.0	79.5	16.5
Noon.	.696	.858	.539	.319	92.5	97.1	77.7	19.4
1	.671	.830	.481	.349	93.4	98.7	77.7	21.0
2	.647	.811	.441	.370	94.0	99.7	77.0	22.7
3	.622	.795	.403	.392	94.0	100.0	76.6	23.4
4	.601	.778	.353	.425	93.3	98.5	75.9	22.6
5	.590	.772	.325	.447	91.9	97.0	77.0	20.0
6	.599	.794	.317	.477	89.6	94.5	76.6	17.9
7	.620	.802	.330	.472	87.4	91.3	76.5	14.8
8	.649	.822	.351	.471	85.6	89.6	76.4	13.2
9	.667	.857	.389	.468	84.7	88.7	77.3	11.4
10	.684	.887	.419	.468	83.6	87.7	76.6	11.1
11	.684	.918	.444	.474	82.8	87.5	75.5	12.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer,	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid- night.	79.0	3.7	76.4	6.3	0.893	9.60	2.12	0.82
1	79.0	3.6	76.5	6.1	.896	.63	.05	.82
2	79.0	3.4	76.6	5.8	.899	.65	1.96	.83
3	79.0	3.2	76.8	5.4	.905	.73	.81	.84
4	79.2	2.9	77.2	4.9	.916	.85	.66	.86
5	79.4	2.6	77.6	4.4	.928	.99	.48	.87
6	79.6	2.6	77.8	4.4	.934	10.05	.49	.87
7	80.5	3.0	78.4	5.1	.952	.21	.79	.85
8	81.2	4.5	78.0	7.7	.940	.03	2.77	.78
9	81.7	6.2	78.0	9.9	.940	9.99	3.65	.73
10	82.2	7.6	77.6	12.2	.928	.83	4.59	.68
11	82.6	8.8	77.3	14.1	.919	.70	5.40	.64
Noon.	82.7	9.8	76.8	15.7	.905	.52	6.07	.61
1	82.9	10.5	76.6	16.8	.899	.44	.55	.59
2	82.8	11.2	76.1	17.9	.885	.28	.99	.57
3	82.6	11.4	75.8	18.2	.876	.20	7.07	.57
4	82.5	10.8	76.0	17.3	.882	.27	6.68	.58
5	82.2	9.7	76.4	15.5	.893	.41	5.91	.61
6	81.7	7.9	77.0	12.6	.910	.63	4.70	.67
7	81.0	6.4	77.2	10.2	.916	.75	3.70	.73
8	80.4	5.2	76.8	8.8	.905	.65	.11	.76
9	80.1	4.6	76.9	7.8	.908	.70	2.72	.78
10	79.3	4.3	76.3	7.3	.890	.55	.48	.79
11	79.0	3.8	76.3	6.5	.890	.55	.20	.81

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1 <sup>1</sup> / <sub>2</sub> ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
1	128.5	...	S. S. W. & variable.	...	100.7	Clear to 4 A. M., strati afterwards.
2	137.7	0.24	S. S. W. & S.	0.8	116.4	Clear to 10 A. M., ci afterwards. Lightning at 8 & 11 P. M. Thunder & rain at 11 P. M.
3	130.5	0.66	S. by E. & S.	6.6	242.6	Stratoni to 3 A. M., ci to 9 A. M., clear to 6 P. M., clouds of different kinds afterwards. High wind from 9 <sup>3</sup> / <sub>4</sub> to 10 <sup>1</sup> / <sub>4</sub> P. M. Lightning at midnight & from 8 to 11 P. M. Thunder at 11 P. M. Rain at 10 & 11 P. M.
4	129.0	0.02	S, S. by E. & S. S. E.	3.0	318.0	ci to 7 A. M., ci to 5 P. M., strati afterwards. Brisk wind from 6 <sup>3</sup> / <sub>4</sub> A. M. to 5 <sup>1</sup> / <sub>2</sub> P. M. Lightning at 7, 8 & 11 P. M. Thunder & light rain at 8 P. M.
5	131.0	...	Variable.	1.0	248.0	Clouds of different kinds. Lightning at midnight & 8 P. M.
6	131.3	...	S.	8.8	282.7	Chiefly ci. High wind & drizzled at 9h. 20m. P. M. Lightning from 9 to 11 P. M.
7	131.0	...	S. by E. & S.	...	194.3	Chiefly clear.
8	133.5	...	S. by W. & S.	1.6	242.9	Chiefly clear. Brisk wind from 8 A. M. to 6 <sup>1</sup> / <sub>2</sub> P. M.
9	132.5	...	S. by W. & S.	2.8	335.9	Clear to 4 A. M., scuds to 11 A. M., clear to 5 P. M., strati afterwards. Brisk wind at 12 <sup>1</sup> / <sub>2</sub> & from 5 <sup>1</sup> / <sub>2</sub> to 8 P. M. & at 11 <sup>3</sup> / <sub>4</sub> P. M.
10	132.0	...	S. S. W.	1.1	355.0	Chiefly clear. Brisk wind from 8 to 11 A. M.
11	134.0	...	S. S. W. & S. by W.	...	287.5	Clear.
12	134.3	...	S. S. W. & S.	1.5	224.0	Chiefly clear. Brisk wind from 6 <sup>3</sup> / <sub>4</sub> to 8 <sup>1</sup> / <sub>4</sub> P. M.
13	131.5	...	S. & S. S. W.	...	251.8	Chiefly clear.
14	134.0	...	S. & S. by W.	...	188.7	Clear to 7 A. M., ci to 2 P. M., clear afterwards. Lightning to N. W. at 9 & 10 P. M.
15	135.0	...	S. & S. by E.	...	167.8	Clouds of different kinds. Lightning to W at 11 P. M.
16	...	2.09	ESE, E. & N. N. W.	17.5	237.7	Overcast. Strong wind from 8 <sup>1</sup> / <sub>4</sub> A. M. to 11 <sup>1</sup> / <sub>2</sub> P. M. Rain at 1 A. M. & from 4 <sup>1</sup> / <sub>2</sub> A. M. to 11 P. M.
17	132.0	...	W. S. W. & S. W.	2.5	488.7	Overcast to 6 A. M., clouds of different kinds afterwards. Brisk wind & slight rain at midnight & 1 A. M. Lighning to S E at 7 & 8 P. M.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
18	132.2	...	S. S. W.	3.8	234.1	Chiefly scuds. High wind from 7¼ A. M. to 11 P. M.
19	127.0	...	S. S. W. & S.	4.6	435.9	Scuds to 7 P. M. Stratoni afterwards. High wind from 8½ A. M. to 7 P. M.
20	128.0	...	S. & S. S. E.	1.5	367.6	Stratoni to noon, ☿ to 6 P. M., ☿ to 9 P. M. Stratoni afterwards. Brisk wind at 9¼ A. M. Slight rain at 9 P. M.
21	127.7	0.02	S. by E. & S.	3.4	197.9	Stratoni to 8 A. M., ☿ to 7 P. M., overcast afterwards. Brisk wind at 7½ P. M. Lightning at 8 & 10 P. M. Thunder & light rain at 8 P. M.
22	124.3	...	S. S. W. & S. by W.	1.1	327.4	Stratoni to 2 A. M., overcast to 9 A. M., clouds of different kinds to 7 P. M., clear afterwards. Brisk wind at 2½ A. M. Slight rain at 6½ A. M.
23	130.2	0.05	S. by W. & S.	9.0	73.1	Clear to 5 A. M., ☿ afterwards. Brisk wind from 12¾ to 3¼ P. M. Strong wind at 8¾ P. M. Light rain at 9 & 11 P. M.
24	131.5	0.03	S. & W. S. W.	3.3	377.3	☿ & scuds. Brisk wind at 2 A. M. & from 5 to 5½ P. M. Lightning to W at 8 P. M. Slight rain at midnight & at 9½ P. M.
25	132.0	...	S. S. W. S. & S. by E.	...	271.6	☿ to 6 P. M., clear afterwards.
26	131.0	...	S. & S. by W.	2.2	343.9	Chiefly clear. Brisk wind from 9 A. M. to 5½ P. M. Lightning at 8½, 9½ & 11 P. M. Slight rain at 9¼ P. M.
27	131.2	...	S. by E. & S.	2.5	348.7	Clouds of different kinds to 11 A. M., ☿ to 3 P. M., clear afterwards. Brisk wind at 2½ & from 7¾ to 9½ A. M. & at 1½ P. M. Lightning to N W at midnight. Slight rain at 1 A. M.
28	130.5	...	S. & S. by W.	2.2	373.1	Clear to 6 A. M., scuds to noon, clear afterwards.

## Solar Radiation, Weather, &amp;c.,

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
29	130.3	0.21	S. & S. by W.	14.0	409.5	Scuds to 6 A. M., clear to 6 P. M., overcast afterwards. Brisk wind nearly the whole day, strong wind at 7¼ & 9½ P. M. Thunder at 8 P. M. Lightning from 8 to 10 P. M. Rain at 7½ & 9 P. M.
30	130.0	...	S. by W. & S.	2.4	373.2	Overcast to 4 A. M., scuds to 4 P. M., clear afterwards. Brisk wind at 2¾ P. M. Lightning to N at 9 P. M.
31	134.0	...	S. & S. by E.	1.8	349.9	Scuds to 10 A. M., ci to 5 P. M., clear afterwards. Brisk wind at 9¾, 11¼ A. M. & at 2½ P. M. Lightning at 9 P. M.

/i Cirri, — i Strati, ~i Cumuli, \i Cirro-strati, ~i Cumulo strati, ~i Nimbi  
 \i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of May 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.662
Max. height of the Barometer occurred at 11 P. M. on the 2nd.	29.918
Min. height of the Barometer occurred at 6 P. M. on the 16th.	29.317
<i>Extreme range</i> of the Barometer during the month	0.601
Mean of the daily Max. Pressures	29.735
Ditto ditto Min. ditto	29.581
<i>Mean daily range</i> of the Barometer during the month	0.154

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	°
Mean Dry Bulb Thermometer for the month	87.0
Max. Temperature occurred at 3 P. M. on the 12th.	100.0
Min. Temperature occurred at 4 A. M. & 11 P. M. on the 3rd. & 22nd.	75.5
<i>Extreme range</i> of the Temperature during the month	24.5
Mean of the daily Max. Temperature	94.7
Ditto ditto Min. ditto	80.1
<i>Mean daily range</i> of the Temperature during the month	14.6

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Mean Wet Bulb Thermometer for the month	80.8
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.2
Computed Mean Dew-point for the month	77.1
Mean Dry Bulb Thermometer above computed mean Dew-point	9.9

	Inches.
Mean Elastic force of Vapour for the month	0.913

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	Troy grain.
Mean Weight of Vapour for the month	9.72
Additional Weight of Vapour required for complete saturation	3.57
Mean degree of humidity for the month, complete saturation being unity	0.73

	°
Mean Max. Solar radiation Thermometer for the month	131.3

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	Inches.
Rained 14 days.—Max. fall of rain during 24 hours	2.09
Total amount of rain during the month	3.32
Total amount of rain indicated by the Gauge attached to the anemometer during the month	2.43
Prevailing direction of the Wind...	S, S. S. W. & S. by W.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

Hour.	N.	Rain on.	N. by E.	N. N. E.	Rain on.	N. E.	Rain on.	E. N. E.	Rain on.	E. by S.	Rain on.	E. S. E.	Rain on.	S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.			
Mid night																																										
1																																										
2																																										
3																																										
4																																										
5																																										
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*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1869.*

Latitude  $22^{\circ} 33' 1''$  North. Longitude  $88^{\circ} 20' 34''$  East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at $32^{\circ}$ Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.663	29.729	29.601	0.128	88.7	95.8	83.8	12.0
2	.655	.717	.579	.138	88.6	94.5	82.6	11.9
3	.583	.635	.498	.137	88.5	96.0	83.0	13.0
4	.559	.618	.498	.120	89.1	96.5	82.6	13.9
5	.565	.627	.491	.136	89.8	98.0	83.4	14.6
6	.512	.575	.416	.159	89.7	97.0	83.5	13.5
7	.436	.504	.374	.130	85.4	87.4	82.0	5.4
8	.334	.437	.220	.217	86.8	95.2	83.0	12.2
9	.022	.287	28.713	.574	79.5	84.0	77.5	6.5
10	.395	.496	29.272	.224	83.1	86.0	79.5	6.5
11	.531	.598	.466	.132	87.9	93.5	84.0	9.5
12	.557	.596	.498	.098	89.3	95.7	85.0	10.7
13	.567	.616	.527	.089	89.8	97.0	85.7	11.3
14	.615	.677	.568	.109	89.1	94.8	83.6	11.2
15	.656	.722	.596	.126	88.6	94.9	84.0	10.9
16	.676	.724	.626	.098	85.7	89.7	82.5	7.2
17	.658	.714	.591	.123	86.5	92.2	81.5	10.7
18	.661	.708	.593	.115	87.1	92.5	82.5	10.0
19	.640	.699	.577	.122	86.3	91.7	82.0	9.7
20	.604	.657	.530	.127	87.4	93.2	83.0	10.2
21	.570	.619	.490	.129	87.6	94.0	82.5	11.5
22	.533	.571	.469	.102	88.0	94.0	83.0	11.0
23	.462	.519	.384	.135	86.4	92.5	83.4	9.1
24	.367	.432	.305	.127	83.8	89.3	82.4	6.9
25	.379	.428	.339	.089	81.9	85.5	80.5	5.0
26	.415	.456	.373	.083	82.8	87.0	79.5	7.5
27	.456	.494	.409	.085	83.2	88.0	79.5	8.5
28	.435	.486	.362	.124	80.4	83.5	77.5	6.0
29	.437	.515	.389	.126	85.0	89.4	83.2	6.2
30	.523	.574	.471	.103	84.0	87.5	81.0	6.5

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	82.1	6.6	78.1	10.6	0.943	10.00	3.96	0.72
2	82.0	6.6	78.0	10.6	.940	9.97	.95	.72
3	82.0	6.5	78.1	10.4	.943	10.02	.86	.72
4	82.2	6.9	78.1	11.0	.943	.00	4.12	.71
5	81.9	7.9	77.2	12.6	.916	9.69	.73	.67
6	82.2	7.5	77.7	12.0	.931	.86	.51	.69
7	81.7	3.7	79.1	6.3	.973	10.40	2.28	.82
8	81.5	5.3	78.3	8.5	.949	.09	3.12	.76
9	78.4	1.1	77.6	1.9	.928	.03	0.63	.94
10	80.5	2.6	78.7	4.4	.961	.33	1.53	.87
11	84.4	3.5	82.3	5.6	1.077	11.44	2.20	.84
12	86.3	3.0	84.5	4.8	.153	12.23	1.98	.86
13	85.7	4.1	83.2	6.6	.108	11.72	2.70	.81
14	84.6	4.5	81.9	7.2	.063	.28	.84	.80
15	83.2	5.4	80.0	8.6	.001	10.62	3.30	.76
16	81.1	4.6	77.9	7.8	0.937	.00	2.80	.78
17	80.9	5.6	77.5	9.0	.925	9.86	3.24	.75
18	81.3	5.8	77.8	9.3	.934	.95	.38	.75
19	81.0	5.3	77.8	8.5	.934	.95	.07	.76
20	82.1	5.3	78.9	8.5	.967	10.28	.17	.76
21	81.6	6.0	78.0	9.6	.940	9.99	.53	.74
22	82.2	5.8	78.7	9.3	.961	10.22	.46	.75
23	82.2	4.2	79.3	7.1	.979	.44	2.62	.80
24	81.6	2.2	80.1	3.7	1.005	.75	1.35	.89
25	80.4	1.5	79.3	2.6	0.979	.53	0.91	.92
26	80.5	2.3	78.9	3.9	.967	.39	1.36	.88
27	80.1	3.1	77.9	5.3	.937	.06	.83	.85
28	79.1	1.3	78.2	2.2	.946	.21	0.73	.93
29	82.3	2.7	80.4	4.6	1.014	.83	1.70	.86
30	81.3	2.7	79.4	4.6	0.983	.51	.66	.86

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid- night.	29.538	29.713	29.233	0.480	84.1	87.0	79.6	7.4
1	.529	.699	.199	.500	83.7	86.8	79.0	7.8
2	.517	.694	.156	.538	83.4	86.6	80.0	6.6
3	.506	.675	.117	.558	83.1	86.4	79.5	6.9
4	.499	.661	.079	.582	82.9	86.2	79.5	6.7
5	.505	.667	.034	.633	82.8	85.8	79.5	6.3
6	.521	.691	.007	.684	82.9	85.7	79.5	6.2
7	.533	.714	28.977	.737	83.9	86.6	79.3	7.3
8	.544	.725	.909	.816	85.3	88.5	79.0	9.5
9	.550	.720	.846	.874	86.7	90.6	79.2	11.4
10	.548	.729	.759	.970	88.0	93.3	77.5	15.8
11	.541	.712	.713	.999	89.4	94.6	77.5	17.1
Noon.	.530	.690	.761	.929	90.1	95.5	77.6	17.9
1	.513	.670	.821	.849	90.7	97.0	78.2	18.8
2	.495	.659	.870	.789	90.9	97.5	78.2	19.3
3	.477	.638	.917	.721	90.5	98.0	78.3	19.7
4	.462	.628	.959	.669	90.2	98.0	78.2	19.8
5	.461	.626	29.011	.615	89.0	96.0	78.2	17.8
6	.473	.641	.073	.568	87.8	94.4	78.3	16.1
7	.493	.656	.115	.541	86.7	92.6	78.0	14.6
8	.514	.664	.186	.478	85.9	91.0	79.7	11.3
9	.531	.691	.238	.453	85.2	88.9	79.6	9.3
10	.546	.722	.271	.451	84.6	87.7	79.5	8.2
11	.546	.718	.259	.459	84.2	87.0	79.5	7.5

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb  
Thermometer Means are derived from the observations made at the several  
hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	°	°	°	°	Inches.	T. gr.	T. gr.	
Mid- night.	81.3	2.8	79.3	4.8	0.979	10.48	1.73	0.86
1	81.2	2.5	79.4	4.3	.983	.54	.53	.87
2	81.2	2.2	79.7	3.7	.992	.63	.33	.89
3	81.1	2.0	79.7	3.4	.992	.66	.20	.90
4	80.9	2.0	79.5	3.4	.986	.60	.19	.90
5	80.9	1.9	79.6	3.2	.989	.63	.12	.91
6	81.0	1.9	79.7	3.2	.992	.66	.13	.90
7	81.5	2.4	79.8	4.1	.995	.66	.47	.88
8	81.8	3.5	79.3	6.0	.979	.46	2.18	.83
9	82.0	4.7	79.2	7.5	.976	.39	.79	.79
10	82.3	5.7	78.9	9.1	.967	.28	3.40	.75
11	82.6	6.8	78.5	10.9	.955	.12	4.13	.71
Noon.	82.8	7.3	78.4	11.7	.952	.06	.48	.69
1	83.0	7.7	78.4	12.3	.952	.06	.74	.68
2	83.0	7.9	78.3	12.6	.949	.01	.88	.67
3	82.8	7.7	78.2	12.3	.946	.00	.72	.68
4	82.9	7.3	78.5	11.7	.955	.10	.49	.69
5	82.7	6.3	78.9	10.1	.967	.26	3.82	.73
6	82.3	5.5	79.0	8.8	.970	.31	.29	.76
7	81.7	5.0	78.7	8.0	.961	.24	2.94	.78
8	81.7	4.2	78.8	7.1	.964	.29	.58	.80
9	81.7	3.5	79.2	6.0	.976	.43	.18	.83
10	81.3	3.3	79.0	5.6	.970	.37	.02	.84
11	81.3	2.9	79.3	4.9	.979	.48	1.76	.86

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
1	129.5	...	S. & S. by E.	...	281.8	Clear to 5 A.M., ☾ to 6 P.M., clear afterwards.
2	133.5	...	S. S. E. & S. by E.	...	221.0	Clear to 5 A. M., ☾ to 7 P.M., clear afterwards.
3	139.0	...	S. S. E. & S. by E.	...	201.5	Clear to 8 A. M., ☾ to 5 P. M., clear afterwards.
4	133.0	...	S, S. E. & S.	...	211.2	Clear to 6 A. M., ☾ to 6 P. M., clear afterwards.
5	136.4	...	S. S. E. & S. by E.	...	233.6	Clear to 6 A. M., ☾ to 4 P. M., clear afterwards.
6	134.0	...	S. S. E. & S. by E.	...	194.2	Clear to 7 A. M., ☾ afterwards. Lightning from 7 to 9 P. M.
7		0.46	S. S. E. & E. S. E.	...	140.7	Clear to 5 A. M., clouds of different kinds to 10 A. M., overcast to 4 P. M., stratoni afterwards. Rain at 8 and 9 A. M.
8		0.12	N. N. E. & N. E.	5.8	144.4	Clear to 3 A. M., stratoni to 1 P. M., overcast afterwards. High wind from 10½ to 11 P. M. Lightning from 7 to 9 P. M. Slight rain at 2½, 4½, 6 & 10 P. M.
9		10.99	N. N. W. & S. W.	50.0	721.7	Overcast. Heavy gale from 1 A. M., to 7½ P. M. Strong wind from 7½ to 10 P. M. Rain from 1 A. M. to 11 P. M.
10	Broken	0.22	SSW, SW & S by W	4.0	636.7	Overcast. Brisk wind at 3½, 6½ & 10½ A. M. Light rain from midnight to 8 A. M.
11		...	S. S. W. & S.	...	292.3	Stratoni.
12		...	S. by E. & S.	...	188.0	Stratoni to 9. A. M., ☾ to 2 P. M. Stratoni afterwards.
13		0.02	S. by W. & S. S. E.	...	150.0	Stratoni to 5 A. M., ☾ to 10 A. M., clear to 2 P. M., clouds of different kinds afterwards. Thunder at 5 P. M. Slight rain at 4 P. M.
14		...	S. E. & S.	1.0	190.0	☾ to 4 A. M., stratoni & ☾ to noon, ☾ afterwards.
15		...	E. N. E., S. S. E. & S.	...	164.0	Stratoni to 5 P. M., ☾ afterwards.
16		...	S. S. E. & S. E.	...	208.0	☾ to 4 A. M., stratoni afterwards.
17		...	S. S. E., S. & S. by E.	...	233.8	Stratoni to 4 A. M., ☾ to 6 P. M., clear afterwards.
18		...	S. S. E., S. by E. & S.	...	242.7	Stratoni to 2 A. M., ☾ to 7 P. M., clear afterwards.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1869.*

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	o	Inches		lb	Miles	
19		...	S.S.E,S.E&SbyE.	...	138.5	Clear to 7 A. M., ☽i to 6 P. M., clear afterwards. Thunder at 4¾ P. M. Light rain at 12½ A. M.
20		...	S. by E. & S.	...	207.7	Chiefly ☽i. Light rain at 10½ A. M.
21		...	S. & S. by E.	...	221.8	Clear to 4 A. M., ☽i to 6 P. M., clear afterwards.
22		...	S. by E. & S.	...	234.5	Clear to 6 A. M., ☽i to 7 P. M., ☽i afterwards.
23		0.24	S.byE, & variable.	...	185.2	☽i to 4 A. M., ☽i afterwards. Thunder at 2 P. M. Rain at 2 & 3 P. M.
24		1.98	Variable.	0.2	145.4	☽i to 11 A. M., overcast afterwards. Thunder at 9½ P. M. Rain at 2½ A. M., noon, & at 2, 3 & 11 P. M.
25	Broken	0.99	W.byN.&S.byW.	...	125.9	Overcast. Thunder at 3 P. M. Rain from midnight to 8 A. M., and from 3 to 7 P. M., & at 9 P. M.
26		1.62	S.S.W.&S.W.	...	136.8	Chiefly overcast. Thunder at 6 P. M. Rain from midnight to 3 A. M., & at 6½ A. M., & at 3½, 6, & 7 P. M.
27		0.31	S. W.	...	132.9	Stratoni to 5 P. M., overcast afterwards. Rain from 6 to 9 P. M.
28		1.43	S. by W.&S.S.W.	2.4	194.2	Overcast. Brisk wind from 8½ to 9¾ A. M. Rain from 2 to 4 A. M., & from 8½ A. M. to 3 P. M.
29		...	S. S. W. & S.	...	226.6	Overcast to 5 A. M., stratoni afterwards. Lightning to N.W. at 9 P. M. Drizzled at 1 P. M.
30		...	S,S.S.E.&S.byW.	...	128.6	Clouds of different kinds.

☽i Cirri, — i Strati, ☽i Cumuli, ☽i Cirro-strati, ~i Cumulo strati, ~i Nimbi  
☽i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of June 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.516
Max. height of the Barometer occurred at 10 A. M. on the 1st.	29.729
Min. height of the Barometer occurred at 11 A. M. on the 9th.	28.713
<i>Extreme range</i> of the Barometer during the month	1.016
Mean of the daily Max. Pressures	29.581
Ditto ditto Min. ditto	29.441
<i>Mean daily range</i> of the Barometer during the month	0.140

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	°
Mean Dry Bulb Thermometer for the month	86.3
Max. Temperature occurred at 3 & 4 P. M. on the 5th.	98.0
Min. Temperature occurred at 10 & 11 A. M. on the 9th. & 28th.	77.5
<i>Extreme range</i> of the Temperature during the month	20.5
Mean of the daily Max. Temperature	91.9
Ditto ditto Min. ditto	82.2
<i>Mean daily range</i> of the Temperature during the month	9.7

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Mean Wet Bulb Thermometer for the month	81.9
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	4.4
Computed Mean Dew-point for the month	78.8
Mean Dry Bulb Thermometer above computed mean Dew-point	7.5

	Inches.
Mean Elastic force of Vapour for the month	0.964

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	Troy grain.
Mean Weight of Vapour for the month	10.27
Additional Weight of Vapour required for complete saturation	2.75
Mean degree of humidity for the month, complete saturation being unity	0.79

	°
Mean Max. Solar radiation Thermometer for 6 days (broken)	134.2

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	Inches.
Rained 14 days,—Max. fall of rain during 24 hours	10.99
Total amount of rain during the month	18.38
Total amount of rain indicated by the Gauge attached to the anemometer during the month	13.89
Prevailing direction of the Wind...	S.S.E, S. & S. by E.



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1869.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.556	29.610	29.499	.011	85.0	89.5	81.2	8.3
2	.541	.595	.469	.126	86.5	92.0	81.4	10.6
3	.502	.549	.448	.101	84.7	90.5	80.8	9.7
4	.448	.492	.383	.109	85.0	89.8	81.0	8.8
5	.421	.470	.370	.100	84.6	89.1	82.0	7.1
6	.452	.493	.409	.084	83.8	89.2	81.5	7.7
7	.461	.527	.399	.128	82.4	87.5	78.4	9.1
8	.563	.648	.490	.158	82.1	86.0	79.5	6.5
9	.676	.744	.618	.126	84.1	89.0	80.3	8.7
10	.646	.710	.565	.145	85.0	90.0	81.5	8.5
11	.563	.617	.487	.130	85.1	89.6	81.7	7.9
12	.554	.603	.510	.093	84.7	89.2	81.0	8.2
13	.573	.610	.522	.088	82.7	86.5	80.2	6.3
14	.574	.604	.525	.079	81.7	86.0	79.5	6.5
15	.498	.564	.416	.148	83.4	87.5	78.5	9.0
16	.456	.502	.387	.115	82.4	85.4	79.5	5.9
17	.468	.509	.408	.101	83.2	87.8	80.5	7.3
18	.431	.481	.358	.123	83.2	88.0	81.0	7.0
19	.485	.564	.429	.135	82.9	86.7	80.0	6.7
20	.536	.595	.475	.120	80.9	84.7	79.0	5.7
21	.555	.600	.491	.109	79.9	83.5	77.5	6.0
22	.567	.613	.509	.104	83.5	87.7	80.0	7.7
23	.561	.604	.495	.109	82.9	88.0	80.0	8.0
24	.549	.599	.473	.126	82.6	87.4	79.8	7.6
25	.561	.628	.506	.122	83.3	88.0	80.0	8.0
26	.626	.672	.574	.098	84.6	89.8	79.5	10.3
27	.610	.657	.548	.109	86.3	91.6	82.0	9.6
28	.607	.655	.530	.125	87.2	92.7	83.0	9.7
29	.632	.672	.578	.094	87.0	92.6	82.7	9.9
30	.647	.700	.585	.115	85.8	88.7	83.0	5.7
31	.654	.685	.603	.082	84.0	87.6	82.4	5.2

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	82.0	3.0	79.9	5.1	0.998	10.67	1.86	0.85
2	82.6	3.9	80.3	6.2	1.011	.78	2.32	.82
3	82.2	2.5	80.4	4.3	.014	.85	1.57	.87
4	81.0	4.0	78.2	6.8	0.946	.11	2.42	.81
5	81.9	2.7	80.0	4.6	1.001	.70	1.69	.86
6	81.7	2.1	80.2	3.6	.008	.79	.31	.89
7	80.3	2.1	78.8	3.6	0.964	.36	.25	.89
8	79.7	2.4	78.0	4.1	.940	.11	.40	.88
9	81.4	2.7	79.5	4.6	.986	.55	.66	.86
10	82.2	2.8	80.2	4.8	1.008	.77	.76	.86
11	82.1	3.0	80.0	5.1	.001	.70	.87	.85
12	81.0	3.7	78.4	6.3	0.952	.19	2.23	.82
13	80.8	1.9	79.5	3.2	.986	.60	1.12	.90
14	80.0	1.7	78.8	2.9	.964	.38	0.99	.91
15	80.8	2.6	79.0	4.4	.970	.42	1.54	.87
16	80.6	1.8	79.3	3.1	.979	.53	.08	.91
17	81.0	2.2	79.5	3.7	.986	.57	.32	.89
18	80.8	2.4	79.1	4.1	.973	.45	.44	.88
19	80.6	2.3	79.0	3.9	.970	.42	.37	.88
20	79.3	1.6	78.2	2.7	.946	.19	0.91	.92
21	78.5	1.4	77.5	2.4	.925	.00	.78	.93
22	80.0	3.5	77.5	6.0	.925	9.92	2.08	.83
23	79.8	3.1	77.6	5.3	.928	.97	1.82	.85
24	79.6	3.0	77.5	5.1	.925	.94	.74	.85
25	80.1	3.2	77.9	5.4	.937	10.06	.87	.84
26	79.9	4.7	76.6	8.0	.899	9.61	2.78	.78
27	81.7	4.6	78.5	7.8	.955	10.18	.84	.78
28	82.8	4.4	80.2	7.0	1.008	.73	.64	.80
29	82.0	5.0	79.0	8.0	0.970	.33	.96	.78
30	81.9	3.9	79.2	6.6	.976	.41	.42	.81
31	81.1	2.9	79.1	4.9	.973	.42	1.75	.86

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fahrt.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid- night.	29.567	29.684	29.446	0.238	82.2	85.0	79.0	6.0
1	.556	.669	.434	.235	82.0	84.5	78.8	5.7
2	.545	.664	.418	.246	81.7	84.3	78.5	5.8
3	.536	.658	.395	.263	81.5	84.0	78.0	6.0
4	.529	.646	.385	.261	81.3	84.0	77.5	6.5
5	.535	.664	.389	.275	81.0	83.5	78.0	5.5
6	.548	.679	.399	.280	81.1	83.5	78.0	5.5
7	.564	.700	.432	.268	81.9	84.5	78.7	5.8
8	.578	.714	.451	.263	83.1	86.0	79.5	6.5
9	.586	.728	.460	.268	84.0	87.5	79.0	8.5
10	.588	.744	.458	.286	85.0	89.7	78.5	11.2
11	.581	.736	.452	.284	86.0	90.7	78.5	12.2
Noon.	.568	.716	.441	.275	86.6	91.0	78.2	12.8
1	.548	.694	.409	.235	87.2	92.0	78.2	13.8
2	.527	.667	.403	.264	87.0	92.3	80.0	12.3
3	.508	.641	.380	.261	86.5	92.6	80.6	12.0
4	.494	.628	.368	.260	86.6	92.7	80.7	12.0
5	.492	.628	.358	.270	86.3	92.0	80.5	11.5
6	.503	.647	.370	.277	85.5	90.5	80.0	10.5
7	.525	.676	.396	.280	84.4	87.9	79.5	8.4
8	.545	.700	.409	.291	83.7	87.0	80.0	7.0
9	.565	.706	.421	.285	83.3	86.5	79.5	7.0
10	.578	.712	.453	.259	83.0	85.5	79.0	6.5
11	.576	.692	.451	.241	82.5	85.2	79.0	6.2

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid- night.	80.4	1.8	79.1	3.1	0.973	10.47	1.07	0.91
1	80.3	1.7	79.1	2.9	.973	.47	.00	.91
2	80.1	1.6	79.0	2.7	.970	.44	0.93	.92
3	80.0	1.5	78.9	2.6	.967	.41	.90	.92
4	79.8	1.5	78.7	2.6	.961	.35	.89	.92
5	79.7	1.3	78.8	2.2	.964	.40	.74	.93
6	79.8	1.3	78.9	2.2	.967	.43	.74	.93
7	80.4	1.5	79.3	2.6	.979	.53	.91	.92
8	80.9	2.2	79.4	3.7	.983	.54	1.32	.89
9	81.2	2.8	79.2	4.8	.976	.45	.72	.86
10	81.4	3.6	78.9	6.1	.967	.34	2.19	.83
11.	81.8	4.2	78.9	7.1	.967	.32	.59	.80
Noon.	81.9	4.7	79.1	7.5	.973	.36	.78	.79
1	82.3	4.9	79.4	7.8	.983	.45	.92	.78
2	82.1	4.9	79.2	7.8	.976	.39	.90	.78
3	81.8	4.7	79.0	7.5	.970	.33	.77	.79
4	81.7	4.9	78.8	7.8	.964	.27	.87	.78
5	81.7	4.6	78.5	7.8	.955	.18	.84	.78
6	81.5	4.0	78.7	6.8	.961	.26	.46	.81
7	81.1	3.3	78.8	5.6	.964	.31	.00	.84
8	80.9	2.8	78.9	4.8	.967	.37	1.70	.86
9	80.8	2.5	79.0	4.3	.970	.42	.51	.87
10	80.8	2.2	79.3	3.7	.979	.51	.31	.89
11	80.6	1.9	79.3	3.2	.979	.53	.11	.91

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	o	Inches		lb	Miles	
1		...	S. S. W. & S.	...	162.6	Stratoni to 3 A. M. \i to 8 A. M. stratoni to 6 P. M., clear afterwards.
2		...	S. by W. & S. S. W.	1.2	219.2	Clear to 6 A. M. \i to 6 P. M., clear afterwards.
3		0.28	S. by W. & S. by E.	1.2	221.4	Clear to 5 A. M. \i to 1 P. M. overcast to 7 P. M., clear afterwards. Rain at 8 A. M. & from 1½ to 3 P. M.
4		...	S. by W. & S. S. W.	1.3	131.0	Clear to 3 A. M. \i to 9 A. M. \i to 3 P. M., clouds of different kinds afterwards. Lightning from W at 9 P. M.
5		0.15	S. S. W. & W. S. W.	...	179.5	Clouds of different kinds. Thunder at 2 P. M. Light rain at 3½ A. M. & from 1½ to 3 P. M.
6		0.84	W. by S. & S. S. E.	...	93.7	Stratoni to 9 A. M. \i to 1 P. M., overcast afterwards. Thunder at 2 & 3 P. M. Lightning visible at 8, 9, 10 & 11 P. M. Rain at 2½ A. M. & from 2½ to 5 P. M.
7	Broken	0.29	S. by E. & S.	...	90.5	\i to 7 P. M., overcast afterwards. Thunder & Lightning at 4 P. M., Slight rain at 5 & 6 A. M. & at 2, 4, 8 & 11 P. M.
8		0.90	S. & S, S. E.	1.1	149.5	Overcast to 2 P. M. \i to 7 P. M., clear afterwards. Rain at midnight & from 7½ to 11 A. M. & at 1 & 2 P. M.
9		0.28	S. S. E, S. & S. by E.	...	206.5	Clouds of different kinds. Rain at 8½ A. M. & at 1 & 6 P. M.
10		...	S. S. W. & S. by W.	...	189.9	Clear to 4 A. M., clouds of different kinds afterwards. Light rain at 3½ A. M.
11		...	S. S. W. & S.	0.6	215.0	Stratoni to 5 A. M. \i to noon, stratoni to 6 P. M., overcast afterwards. Lightning from W at 9 P. M. Light rain to 3 P. M.
12		0.12	S. by W. & S.	0.4	223.6	Stratoni to 1 P. M. \i to 7 P. M. stratoni afterwards. Lightning at 8 & 11 P. M. Thunder at 11 P. M. Slight rain at 12 A. M. & 1 & 11 P. M.
13		2.89	S. W, S. & S. by E.	1.0	181.5	Overcast. Thunder & lightning at midnight & 1 A. M. Rain nearly the whole day,

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taken at the Surveyor General's Office, Calcutta,  
in the month of July 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1 $\frac{1}{8}$ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	o	Inches		lb	Miles	
14	Broken	2.59	S. & S. S. W.	0.2	146.7	Overcast to 2 p. m., strati afterwards. Rain from midnight to 9 A. M. & at 1 & 2 p. m.
15		0.18	S. & S. S. W.	0.5	194.6	Overcast to 8 A. M., strati afterwards. Slight rain from 4 to 6 A. M. & at 1 $\frac{1}{2}$ & 2 $\frac{1}{2}$ p. m.
16		1.34	S. by E. & S. S. E.	1.0	164.2	\i to 3 A. M., Overcast to 2 p. m., \i & \i afterwards. Rain at 4 $\frac{1}{2}$ A. M. & from 7 to 12 A. M. & at 6 p. m.
17		1.38	E. S. E. & variable.	...	138.6	Strati to 5 A. M. \i to 12 A. M., overcast afterwards. Thunder & Lightning to 7 p. m. Rain from 1 to 3 p. m. & from 6 $\frac{1}{2}$ to 8 p. m.
18		0.49	E. & variable.	...	145.3	Chiefly strati. Rain at 4 $\frac{1}{2}$ 5 $\frac{3}{4}$ & 9 $\frac{1}{2}$ A. M. & at 2, 3 & 10 $\frac{1}{2}$ p. m.
19		0.24	S. E. & S. S. E.	...	223.6	Chiefly Strati. Thunder at 2 p. m. Slight rain after intervals.
20		0.38	E by S, E. S. E. & S.	...	186.0	Strati to 6 A. M., overcast afterwards. Slight rain after intervals.
21		1.77	S. S. E, S. & S. by E.	...	198.5	Overcast to 12 A. M. clouds of different kinds afterwards. Rain from 2 A. M. to 2 p. m. & at 6 $\frac{1}{2}$ p. m.
22		...	SSE, S. E. & S. by E.	...	182.6	\i to 12 A. M. \i afterwards.
23		0.27	S. S. E, S. E. & ESE.	...	208.5	Chiefly \i. Slight rain after intervals.
24		0.05	E. S. E, E. & S. E.	3.0	244.9	Clouds of different kinds. Slight rain at noon 3 $\frac{1}{2}$ & 11 $\frac{1}{2}$ p. m.
25		...	E. S. E, S. & S. by E.	...	270.2	Clouds of different kinds. Light rain after intervals.
26		0.10	S. by E. & S.	...	175.0	\i to 5 A. M. \i to 5 p. m. clouds of different kinds after- wards. Slight rain at 1 A. M.
27		...	S. by E, S. by W. & S.	...	151.8	\i to 7 p. m. clear afterwards.
28		...	S. & S. by E.	...	112.0	\i to 7 A. M. \i afterwards. Thunder at 6 p. m. Lightning from 9 to 11 p. m.
29		...	S by E, S. & S. by W.	...	163.4	Chiefly \i Drizzled at 5 $\frac{1}{2}$ p. m.
30		...	S.	...	159.6	\i to 5 A. M. \i to 7 p. m. clear afterwards.
31		...	S. by E. & S.	...	151.2	\i to 6 A. M. \i to 11 A. M., strati to 3 p. m. \i to 8 p. m. clear afterwards. Thunder at noon. Drizzled at 1 $\frac{1}{2}$ & 6 p. m.

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, \i Cumulo strati, \i Nimbi  
\i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of July 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.547
Max. height of the Barometer occurred at 10 A. M. on the 9th.	29.744
Min. height of the Barometer occurred at 5 P. M. on the 18th.	29.358
<i>Extreme range</i> of the Barometer during the month	0.386
Mean of the daily Max. Pressures	29.599
Ditto ditto Min. ditto	29.486
<i>Mean daily range</i> of the Barometer during the month	0.113

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	o
Mean Dry Bulb Thermometer for the month	83.9
Max. Temperature occurred at 4 P. M. on the 28th.	92.7
Min. Temperature occurred at 4 A. M. on the 21st.	77.5
<i>Extreme range</i> of the Temperature during the month	15.2
Mean of the daily Max. Temperature	88.4
Ditto ditto Min. ditto	80.6
<i>Mean daily range</i> of the Temperature during the month	7.8

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Mean Wet Bulb Thermometer for the month	80.9
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	3.0
Computed Mean Dew-point for the month	78.8
Mean Dry Bulb Thermometer above computed mean Dew-point	5.1

	Inches.
Mean Elastic force of Vapour for the month	0.964

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	Troy grain.
Mean Weight of Vapour for the month	10.34
Additional Weight of Vapour required for complete saturation	1.79
Mean degree of humidity for the month, complete saturation being unity	0.85

	o
Mean Max. Solar radiation Thermometer for the month	(broken)

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	Inches.
Rained 24 days,—Max. fall of rain during 24 hours	2.89
Total amount of rain during the month	14.54
Total amount of rain indicated by the Gauge attached to the anemometer during the month	13.22
Prevailing direction of the Wind... S, S. by E. & S by W.	



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1869.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.648	29.686	29.604	0.082	82.2	83.5	80.3	3.2
2	.686	.728	.646	.082	82.5	85.3	79.2	6.1
3	.728	.798	.672	.126	84.8	89.8	81.0	8.8
4	.730	.793	.654	.139	85.7	90.6	82.2	8.4
5	.655	.738	.569	.169	85.4	90.5	81.8	8.7
6	.583	.640	.500	.140	84.1	89.8	79.5	10.3
7	.604	.678	.534	.144	83.1	88.5	79.5	9.0
8	.680	.738	.625	.113	83.6	88.2	80.0	8.2
9	.710	.776	.652	.124	83.3	85.5	81.3	4.2
10	.678	.724	.619	.105	84.9	89.0	82.0	7.0
11	.713	.757	.667	.090	84.9	90.4	82.0	8.4
12	.747	.803	.683	.120	81.1	84.4	77.3	7.1
13	.776	.834	.719	.115	84.4	89.5	80.0	9.5
14	.756	.836	.676	.160	85.4	90.7	82.0	8.7
15	.691	.760	.602	.158	85.7	91.6	81.3	10.3
16	.646	.699	.567	.132	86.1	91.5	82.0	9.5
17	.604	.667	.525	.142	85.8	89.5	83.6	5.9
18	.561	.618	.481	.137	85.7	93.4	81.6	11.8
19	.622	.676	.574	.102	85.0	91.0	82.7	8.3
20	.672	.726	.611	.115	85.9	90.6	81.5	9.1
21	.684	.738	.617	.121	84.3	89.2	81.7	7.5
22	.608	.695	.516	.179	84.9	90.4	81.6	8.8
23	.511	.575	.420	.155	84.7	89.5	81.8	7.7
24	.503	.560	.446	.114	84.2	88.5	82.2	6.3
25	.571	.636	.523	.113	84.1	88.2	81.7	6.5
26	.633	.677	.581	.096	85.1	90.0	81.5	8.5
27	.641	.706	.563	.143	85.7	90.7	81.6	9.1
28	.609	.666	.527	.139	86.0	91.2	82.0	9.2
29	.592	.633	.541	.092	84.5	89.0	82.0	7.0
30	.614	.653	.567	.086	83.2	85.8	80.7	5.1
31	.643	.693	.594	.099	83.4	87.5	80.0	7.5

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	80.8	1.4	79.8	2.4	0.995	10.71	0.83	0.93
2	80.2	2.3	78.6	3.9	.958	.30	1.34	.89
3	80.9	3.9	78.2	6.6	.946	.11	2.35	.81
4	81.5	4.2	78.6	7.1	.958	.23	.57	.80
5	81.5	3.9	78.8	6.6	.964	.29	.39	.81
6	81.1	3.0	79.0	5.1	.970	.40	1.81	.85
7	80.2	2.9	78.2	4.9	.946	.15	.71	.86
8	80.5	3.1	78.3	5.3	.949	.18	.85	.85
9	81.3	2.0	79.9	3.4	.998	.72	.21	.90
10	81.9	3.0	79.8	5.1	.995	.64	.85	.85
11	81.4	3.5	78.9	6.0	.967	.34	2.15	.83
12	78.9	2.2	77.4	3.7	.922	9.93	1.24	.89
13	80.4	4.0	77.6	6.8	.928	.93	2.38	.81
14	81.2	4.2	78.3	7.1	.949	10.14	.54	.80
15	81.7	4.0	78.9	6.8	.967	.32	.48	.81
16	82.5	3.6	80.0	6.1	1.001	.68	.27	.83
17	83.0	2.8	81.0	4.8	.034	11.03	1.80	.86
18	82.0	3.7	79.4	6.3	0.983	10.49	2.31	.82
19	82.1	2.9	80.1	4.9	1.005	.73	1.80	.86
20	81.9	4.0	79.1	6.8	0.973	.38	2.49	.81
21	81.6	2.7	79.7	4.6	.992	.61	1.67	.86
22	81.9	3.0	79.8	5.1	.995	.64	.85	.85
23	81.8	2.9	79.8	4.9	.995	.64	.78	.86
24	81.8	2.4	80.1	4.1	1.005	.75	.49	.88
25	81.6	2.5	79.8	4.3	0.995	.66	.55	.87
26	81.8	3.3	79.5	5.6	.986	.53	2.04	.84
27	81.9	3.8	79.2	6.5	.976	.41	.39	.81
28	82.0	4.0	79.2	6.8	.976	.41	.50	.81
29	80.9	3.6	78.4	6.1	.952	.19	.16	.83
30	80.5	2.7	78.6	4.6	.958	.28	1.61	.87
31	80.6	2.8	78.6	4.8	.958	.28	.68	.86

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	°	°	°	°
Mid- night.	29.664	29.776	29.516	0.260	82.8	85.0	79.4	5.6
1	.653	.768	.493	.275	82.5	84.6	79.8	4.8
2	.644	.760	.472	.288	82.3	84.3	79.8	4.5
3	.636	.751	.450	.301	82.0	84.0	79.6	4.4
4	.630	.764	.446	.318	81.8	83.8	79.5	4.3
5	.639	.776	.477	.299	81.6	83.8	78.7	5.1
6	.654	.794	.492	.302	81.5	83.6	77.3	6.3
7	.671	.809	.515	.294	82.2	84.5	78.0	6.5
8	.686	.823	.531	.292	83.6	85.6	78.3	7.3
9	.696	.832	.543	.289	85.2	87.2	81.0	6.2
10	.697	.836	.550	.286	86.2	89.5	80.5	9.0
11	.690	.831	.551	.280	87.0	90.0	80.5	9.5
Noon.	.674	.812	.526	.286	87.5	91.5	81.5	10.0
1	.649	.792	.494	.298	87.9	92.3	81.0	11.3
2	.624	.767	.476	.291	88.1	93.0	80.5	12.5
3	.603	.752	.449	.303	87.8	93.4	82.0	11.4
4	.590	.734	.437	.297	87.4	93.2	83.0	10.2
5	.587	.719	.420	.299	86.7	90.5	82.0	8.5
6	.597	.731	.429	.302	85.7	89.6	80.3	9.3
7	.616	.737	.465	.272	84.6	87.5	80.0	7.5
8	.642	.758	.494	.264	83.9	86.0	79.5	6.5
9	.664	.773	.515	.258	83.5	86.0	79.5	6.5
10	.676	.786	.521	.265	83.3	85.5	80.0	5.5
11	.676	.783	.522	.261	83.1	85.3	79.7	5.6

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb  
Thermometer Means are derived from the observations made at the several  
hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid- night.	80.8	2.0	79.4	3.4	0.983	10.56	1.19	0.90
1	80.6	1.9	79.3	3.2	.979	.53	.11	.91
2	80.5	1.8	79.2	3.1	.976	.50	.08	.91
3	80.4	1.6	79.3	2.7	.979	.53	0.94	.92
4	80.3	1.5	79.2	2.6	.976	.50	.90	.92
5	80.2	1.4	79.2	2.4	.976	.52	.82	.93
6	80.2	1.3	79.3	2.2	.979	.55	.76	.93
7	80.7	1.5	79.6	2.6	.989	.63	.91	.92
8	81.1	2.5	79.3	4.3	.979	.51	1.52	.87
9	81.8	3.4	79.4	5.8	.983	.49	2.12	.83
10	82.1	4.1	79.2	7.0	.976	.41	.58	.80
11	82.1	4.9	79.2	7.8	.976	.39	.90	.78
Noon.	82.3	5.2	79.2	8.3	.976	.39	3.10	.77
1	82.4	5.5	79.1	8.8	.973	.34	.30	.76
2	82.6	5.5	79.3	8.8	.979	.40	.32	.76
3	82.6	5.2	79.5	8.3	.986	.49	.11	.77
4	82.5	4.9	79.6	7.8	.989	.52	2.93	.78
5	82.2	4.5	79.5	7.2	.986	.51	.67	.80
6	81.7	4.0	78.9	6.8	.967	.32	.48	.81
7	81.4	3.2	79.2	5.4	.976	.45	1.94	.84
8	81.0	2.9	79.0	4.9	.970	.40	.73	.86
9	80.7	2.8	78.7	4.8	.961	.31	.69	.86
10	80.9	2.4	79.2	4.1	.976	.48	.45	.88
11	80.9	2.2	79.4	3.7	.983	.54	.32	.89

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	0	Inches		lb	Miles	
1		0.24	S. S. W. & S.	...	225.8	Overcast. Rain from 2 to 4 A.M., and from 11 A.M. to 2 P.M.
2		0.31	S,SbyW.&S.byE.	...	112.6	Chiefly straton. Rain at 3, 5, 7, 8 & 10 A. M.
3		...	S,S.byE&S.byW.	...	322.4	\i & \i to 6 P. M., clear afterwards.
4		...	S. S. W. & S.	...	227.1	\i & \i nearly the whole day
5		...	S.S.W. & S.by W.	0.6	260.9	\i & \i to 6 P. M., overcast afterwards. Thunder at 8 P. M. Lightning at 8 & 9 P. M. Drizzled at 6½ P. M.
6		0.76	S. S. W. & S. by W.	2.0	256.0	Straton to 5 P. M. Overcast afterwards. Brisk wind at 5½ P. M. Thunder at 6, 8½ & 11 P. M. Lightning at 8½ P. M., Rain from 3½ to 11 P. M.
7	Broken	0.21	S. & S. by E.	...	161.5	Overcast to 6 A. M., straton to 11 A.M. \i afterwards. Lightning at 8 & 9 P. M. Rain at midnight & 1 A. M. & at 9½ P. M.
8		...	S,S.S.W&S.byW.	...	129.5	Straton to 6 A. M., overcast to 10 A. M., straton afterwards. Lightning from N W at 8 P. M.
9		...	S.S.W,SbyW.&S.	...	152.4	Straton to 7 A. M., overcast to 7 P.M., clear afterwards. Drizzled at 8, 10 & 12½ A. M.
10		...	S. S. W. & S.	...	212.1	Clear to 4 A. M., \i & \i to 10 A. M. \i to 4. P. M., overcast afterwards. Drizzled at 9 P. M.
11		...	S,S.byE. & S.S.E.	...	207.5	Straton to 6 A. M. \i to 3 P. M. \i afterwards. Drizzled at 12½ A. M.
12		1.73	S. S. E. & S.	...	155.0	Overcast to 2 P. M., clouds of different kinds afterwards. Rain from 3 to 7 & Drizzled from 9 A. M. to 2 P. M.
13	111.5	...	S,SbyW.&S.S.W.	...	162.0	Clear to 7 A.M. \i afterwards. Lightning from W at 8 P. M.
14	113.0	...	S. S. W. & S.	...	230.0	Straton to 6 P. M. \i afterwards. Lightning to W from 8 to 10 P. M.
15	114.5	...	W. & S.	...	103.4	Clear to 4 A.M. \i afterwards. Lightning at 9 P. M.
16	108.0	...	S.S.W.&W.S.W.	...	111.3	Clear to 5 A. M. \i to 9 A. M. \i afterwards. Lightning at 7 & 8 P. M.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1869.*

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
17	122.7	0.11	S. by W. & S by E.	...	100.7	\\i to 6 A. M. ^i to 7 P. M. \\i afterwards. Thunder at 12 A. M. Lightning at 7½ & 9 P. M. Rain at 12 A. M. & 3 P. M.
18	134.0	1.61	E. S. E. W.S.W, S.S.E. &]	0.8	80.0	\\i to 8 A. M. ^i afterwards. Thunder at 4¼ P. M. Lightning at 4¼ & 10 P. M., Rain at 2½ & 5 P. M.
19	128.0	0.24	S. E. & E. S. E.	...	124.8	\\i to 4 A. M., straton to 9 A. M. ^i to 6 P. M., straton afterwards. Thunder at 2¾ P. M. Lightning at 7½ P. M., Rain at 3 P. M.
20	129.4	...	S. & E. S. E.	...	74.5	Chiefly ^i Drizzled at 4 A.M.
21	120.0	0.05	S.	...	128.3	Clear to 3 A. M., \\i to 8 A. M. ^i to 12 A. M., straton afterwards. Thunder at 1 P. M. Light rain at 6 A. M. & at 1½, 3 & 11 P. M.
22	135.5	0.18	S. & S. by W.	...	86.1	Chiefly ^i Thunder at 2 & 3½ P. M., Rain at 3½ P. M.
23	113.0	0.16	S.S.W, S. & S.S.E.	...	93.2	Chiefly ^i, Rain at 8½ & 9½ A.M.
24	133.6	0.16	S. S. E, S. E. & S.	...	101.9	Chiefly ^i Thunder & Lightning at 9¼ P. M., Slight rain at 5½ & 11 A. M. & at 3 & 4½ P. M.
25	124.6	0.17	S.S.W, S. & S. by E.	...	90.7	^i to 6 P. M., clear afterwards. Rain at 11½ A. M. & at 5½ P. M.
26	132.0	0.04	S. by E, S.S.E. & S.	...	173.6	Clear to 6 A. M. ^i to 6 P. M. clear afterwards. Light rain at 1¼, 2½ & 5 P. M.
27	132.5	...	S. by E. & S.	...	161.2	Clear to 5 A. M. ^i to 8 P. M., clear afterwards. Drizzled at 1½ P. M.
28	131.0	...	S. by E. & S. S. E.	...	130.3	Clear to 6 A.M., ^i afterwards Drizzled at 1 P. M.
29	128.4	0.05	S.	...	115.3	Straton to 3 A. M. \\i to 7 A. M. ^i to 6 P. M., clear afterwards. Thunder at 1 P. M. Lightning at 7¼ P. M., Slight rain at 2¼ P. M.
30	...	...	E. S. E.	...	170.7	\\i to 4 A. M., straton to 6 P. M., clear afterwards. Drizzled at 5½ A. M. & at 1 P. M.
31	125.2	...	S. E. & S. S. E.	...	199.2	\\i to 3 A. M., overcast to 6 A. M., straton to 6 P. M., clear afterwards Drizzled at 4, 6 & 12 A. M. & at 3 P. M.

\\i Cirri, — i Strati, ^i Cumuli, \\i Cirro-strati, ^i Cumulo strati, \\i Nimbi  
\\i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of August 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.648
Max. height of the Barometer occurred at 10 A. M. on the 14th.	29.836
Min. height of the Barometer occurred at 5 P. M. on the 23rd.	29.420
<i>Extreme range</i> of the Barometer during the month	0.416
Mean of the daily Max. Pressures	29.707
Ditto ditto Min. ditto	29.583
<i>Mean daily range</i> of the Barometer during the month	0.124

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	°
Mean Dry Bulb Thermometer for the month	84.5
Max. Temperature occurred at 3 P. M. on the 18th.	93.4
Min. Temperature occurred at 6 A. M. on the 12th.	77.3
<i>Extreme range</i> of the Temperature during the month	16.1
Mean of the daily Max. Temperature	89.1
Ditto ditto Min. ditto	81.2
<i>Mean daily range</i> of the Temperature during the month	7.9

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Mean Wet Bulb Thermometer for the month	81.3
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	3.2
Computed Mean Dew-point for the month	79.1
Mean Dry Bulb Thermometer above computed mean Dew-point	5.4

	Inches.
Mean Elastic force of Vapour for the month	0.973

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	Troy grain.
Mean Weight of Vapour for the month	10.42
Additional Weight of Vapour required for complete saturation	1.93
Mean degree of humidity for the month, complete saturation being unity	0.84

	°
Mean Max. Solar radiation Thermometer for the month	124.3

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	Inches.
Rained 24 days,—Max. fall of rain during 24 hours	1.73
Total amount of rain during the month	6.02
Total amount of rain indicated by the Gauge attached to the anemometer during the month	5.50
Prevailing direction of the Wind... S, S. S W. & S. by W.	



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1869.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahlt.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.649	29.710	29.557	0.153	84.7	89.5	80.5	9.0
2	.611	.680	.541	.139	84.8	91.0	80.4	10.6
3	.629	.681	.579	.102	83.9	87.6	81.0	6.6
4	.664	.715	.612	.103	81.9	84.8	80.2	4.6
5	.685	.740	.626	.114	82.9	87.3	80.0	7.3
6	.670	.728	.595	.133	84.0	88.2	81.4	6.8
7	.643	.719	.584	.135	84.2	88.6	80.0	8.6
8	.639	.688	.574	.114	81.5	83.4	79.5	3.9
9	.630	.671	.570	.101	82.4	87.0	80.0	7.0
10	.653	.718	.590	.128	82.1	86.8	80.3	6.5
11	.649	.699	.565	.134	81.5	87.3	79.4	7.9
12	.678	.748	.610	.138	81.3	87.2	79.0	8.2
13	.741	.803	.677	.126	82.4	86.5	79.0	7.5
14	.753	.824	.661	.163	84.1	89.3	80.0	9.3
15	.723	.790	.647	.143	85.0	90.0	81.0	9.0
16	.683	.749	.604	.145	84.5	89.0	80.9	8.1
17	.670	.724	.593	.131	84.7	91.3	81.2	10.1
18	.683	.745	.611	.134	84.1	88.8	81.0	7.8
19	.667	.738	.591	.147	84.1	89.0	80.5	8.5
20	.660	.705	.612	.093	84.0	90.0	80.8	9.2
21	.691	.736	.628	.108	84.2	92.0	80.0	12.0
22	.697	.765	.633	.132	84.0	90.4	80.4	10.0
23	.718	.771	.657	.114	81.2	85.7	78.0	7.7
24	.726	.799	.660	.139	79.9	81.6	78.0	3.6
25	.733	.794	.678	.116	80.3	85.4	78.5	6.9
26	.727	.782	.664	.118	81.3	85.5	79.0	6.5
27	.768	.836	.716	.120	83.3	88.5	79.0	9.5
28	.760	.820	.701	.119	83.8	89.2	79.5	9.7
29	.753	.815	.686	.129	84.0	89.0	80.7	8.3
30	.783	.841	.706	.135	83.1	89.0	80.0	9.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	81.3	3.4	78.9	5.8	0.967	10.34	2.08	0.83
2	80.7	4.1	77.8	7.0	.934	9.99	.47	.80
3	81.0	2.9	79.0	4.9	.970	10.40	1.73	.86
4	79.9	2.0	78.5	3.4	.955	.29	.15	.90
5	80.6	2.3	79.0	3.9	.970	.42	.37	.88
6	81.1	2.9	79.1	4.9	.973	.42	.75	.86
7	81.6	2.6	79.8	4.4	.995	.66	.58	.87
8	80.3	1.2	79.5	2.0	.986	.62	0.69	.94
9	80.5	1.9	79.2	3.2	.976	.50	1.11	.90
10	80.0	2.1	78.5	3.6	.955	.27	.24	.89
11	79.5	2.0	78.1	3.4	.943	.16	.15	.90
12	79.6	1.7	78.4	2.9	.952	.25	0.99	.91
13	80.3	2.1	78.8	3.6	.964	.36	1.25	.89
14	80.8	3.3	78.5	5.6	.955	.23	.98	.84
15	81.2	3.8	78.5	6.5	.955	.21	2.32	.82
16	81.1	3.4	78.7	5.8	.961	.29	.06	.83
17	81.4	3.3	79.1	5.6	.973	.40	.02	.84
18	81.3	2.8	79.3	4.8	.979	.48	1.73	.86
19	81.2	2.9	79.2	4.9	.976	.45	.76	.86
20	80.9	3.1	78.7	5.3	.961	.31	.86	.85
21	80.9	3.3	78.6	5.6	.958	.26	.98	.84
22	81.1	2.9	79.1	4.9	.973	.42	.75	.86
23	79.2	2.0	77.8	3.4	.934	.07	.14	.90
24	78.6	1.3	77.7	2.2	.931	.06	0.72	.93
25	79.0	1.3	78.1	2.2	.943	.18	.73	.93
26	79.5	1.8	78.2	3.1	.946	.19	1.05	.91
27	79.9	3.4	77.5	5.8	.925	9.92	2.01	.83
28	80.5	3.3	78.2	5.6	.946	10.13	1.97	.84
29	80.4	3.6	77.9	6.1	.937	.04	2.13	.83
30	79.9	3.2	77.7	5.4	.931	.00	1.86	.84

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid- night.	29.707	29.813	29.605	0.208	81.5	83.4	79.2	4.2
1	.694	.788	.599	.189	81.3	83.2	79.2	4.0
2	.685	.775	.588	.187	81.0	83.0	79.0	4.0
3	.676	.766	.580	.186	80.7	82.4	78.8	3.6
4	.668	.760	.569	.191	80.4	82.4	78.5	3.9
5	.680	.780	.585	.195	80.2	82.0	78.0	4.0
6	.692	.799	.607	.192	80.2	81.7	78.0	3.7
7	.715	.821	.633	.188	80.9	83.0	78.0	5.0
8	.735	.836	.666	.170	82.4	84.7	78.5	6.2
9	.745	.839	.669	.170	83.9	86.5	79.5	7.0
10	.747	.841	.671	.170	85.5	87.8	80.2	7.6
11	.738	.825	.655	.170	86.1	89.3	79.0	10.3
Noon.	.716	.798	.641	.157	86.2	90.6	79.0	11.6
1	.687	.777	.609	.168	86.6	91.0	80.0	11.0
2	.657	.739	.572	.167	86.8	92.0	81.0	11.0
3	.638	.717	.549	.168	86.0	91.0	81.0	10.0
4	.629	.718	.546	.172	85.3	89.3	81.0	8.3
5	.631	.740	.541	.199	84.8	88.5	80.2	8.3
6	.645	.746	.561	.185	83.7	87.0	79.5	7.5
7	.663	.759	.576	.183	83.0	86.0	79.9	6.1
8	.692	.787	.595	.192	82.5	85.0	79.7	5.3
9	.712	.800	.615	.185	82.2	84.5	79.7	4.8
10	.718	.815	.605	.210	81.8	83.6	79.5	4.1
11	.716	.814	.608	.206	81.7	83.5	79.5	4.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb  
Thermometer Means are derived from the observations made at the several  
hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Thermometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humidity, complete saturation being unity.
	°	°	°	°	Inches.	T. gr.	T. gr.	
Mid-night.	80.0	1.5	78.9	2.6	0.967	10.41	0.90	0.92
1	79.9	1.4	78.9	2.4	.967	.43	.81	.93
2	79.7	1.3	78.8	2.2	.964	.40	.74	.93
3	79.4	1.3	78.5	2.2	.955	.31	.73	.93
4	79.3	1.1	78.5	1.9	.955	.31	.63	.94
5	79.2	1.0	78.5	1.7	.955	.31	.57	.95
6	79.3	0.9	78.7	1.5	.961	.37	.51	.95
7	79.8	1.1	79.0	1.9	.970	.46	.64	.94
8	80.4	2.0	79.0	3.4	.970	.44	1.17	.90
9	80.9	3.0	78.8	5.1	.964	.34	.79	.85
10	81.3	4.2	78.4	7.1	.952	.17	2.55	.80
11	81.4	4.7	78.1	8.0	.943	.06	.89	.78
Noon.	81.5	4.7	78.2	8.0	.946	.09	.90	.78
1	81.4	5.2	78.3	8.3	.949	.12	3.02	.77
2	81.8	5.0	78.8	8.0	.964	.27	2.94	.78
3	81.5	4.5	78.3	7.7	.949	.12	.79	.78
4	81.2	4.1	78.3	7.0	.949	.14	.50	.80
5	80.9	3.9	78.2	6.6	.946	.11	.35	.81
6	80.6	3.1	78.4	5.3	.952	.21	1.86	.85
7	80.4	2.6	78.6	4.4	.958	.30	.52	.87
8	80.2	2.3	78.6	3.9	.958	.30	.34	.89
9	80.3	1.9	79.0	3.2	.970	.44	.10	.91
10	80.1	1.7	78.9	2.9	.967	.41	0.99	.91
11	80.1	1.6	79.0	2.7	.970	.44	.93	.92

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure.	Daily Velocity.	
	°	Inches		lb	Miles	
1	121.1	0.25	E.S.E, E. & S. S. E.	...	149.9	Clear to 5 A. M., ☿ to 4 P. M., clear afterwards. Lightning from W. at 9¼ P. M. Rain at 1½ & 7½ P. M.
2	130.0	0.26	S. S. E. & E. S. E.	...	121.1	Clear to 5 A. M. ☿ to 10 A. M. ☿ to 6 P. M., clear afterwards. Rain at 2½ P. M.
3	118.0	0.12	S. E. & S. S. E.	...	185.2	Clear to 5 A. M., ☿ to 7 P. M., clear afterwards. Slight rain at 11½ & 12½ A. M. & at 2½ P. M.
4	...	0.33	S. S. E. & S. by E.	...	150.4	Stratoni to 4 A. M., overcast to noon, ☿ to 4 P. M., clouds of different kinds to 8 P. M., clear afterwards. Rain at 5, 7 & 11 A. M.
5	125.0	...	S. S. E. S. by W. & S.	...	97.6	Clear to 3 A. M. Stratoni to 9 A. M., ☿ to 6 P. M., clear afterwards.
6	124.0	...	S. S. W. & S.	...	218.3	Clear to 4 A. M., ☿ to noon, stratoni afterwards. Lightning to W. at 7 & 8 P. M.
7	123.0	...	S. & S. by E.	...	216.0	Chiefly stratoni. Thunder at 4 P. M. Lightning to S. W. at 8 P. M. Drizzled at 4½ P. M.
8	...	1.70	S. by E. & S.	...	166.3	Stratoni to 2 A. M., overcast to 6 P. M., stratoni afterwards. Thunder at midnight 1, 2, 3 & 4 A. M. Lightning at midnight, 1, 2, 3 & 4 A. M. & at 10 P. M. Rain from 2½ to 9 A. M. & drizzled at 4 & 5 P. M.
9	...	1.88	S. S. E. & S. E.	...	97.8	Overcast to 6 A. M., ☿ to 1 P. M., overcast afterwards. Thunder at 5¼ P. M. Lightning at 8 P. M. Rain from 1 to 3 A. M. & at 2, 6¾ & 8 P. M.
10	125.2	...	S. S. E. E. & E. by S.	...	130.8	Chiefly stratoni. Dizzled at 3 P. M.
11	132.0	0.15	E. by S. & E. S. E.	1.0	179.4	Clouds of different kinds. Thunder at 2 P. M. Lightning at 10¾ P. M. Rain at 1 A. M., noon & 2½ P. M.
12	127.4	0.13	S. E. & E. S. E.	...	137.0	Clouds of different kinds. Thunder at 12½ A. M. & 1 P. M. Lightning to S. W. at 11 P. M. Slight rain at 4¼ A. M. & 1, 3½ & 6 P. M.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
13	124.4	...	E. S. E. & S by E.	...	138.7	\\i to 6 A. M., \\i to 11 A. M., straton afterwards. Drizzled at noon & 4 P. M.
14	134.0	...	S. by E. & S.	...	53.3	Clear to 3 A. M. \\i to 7 A. M. \\i to 6 P. M., clear afterwards. Lightning from W. at 1 A. M. Drizzled at 9½ A. M.
15	131.6	...	S. by E. & S.	...	141.0	Clear to 6 A. M., \\i to 4 P. M., straton afterwards. Lightning to N. at 7 P. M.
16	131.0	...	S. & S. S. W.	...	161.9	Straton to 6 A. M., \\i to 5 PM. \\i afterwards. Drizzled at 3 A. M.
17	133.0	0.21	S. & S. by W.	0.6	125.3	Clouds of different kinds to 8 A. M., \\i to 3 P. M., straton afterwards. Thunder at 4½ P. M. Lightning at 6¼, 7 & 8 P. M. Rain at 4, 5½ & 8 P. M.
18	131.2	0.12	S. by W. & S. S. E.	...	104.1	Chiefly \\i. Slight rain at noon & 10 P. M.
19	132.5	0.04	S. E. & S. S. E.	...	89.3	Chiefly \\i. Slight rain at 2½ P. M.
20	135.4	0.04	S. S. E, S. E. & S.	...	103.5	Clear to 5 A. M. \\i to 6 P. M., \\i afterwards. Slight rain at 1½ & 2½ P. M.
21	135.4	0.44	S & variable.	...	73.0	Straton to 6 A. M., \\i to 2 P. M., clouds of different kinds afterwards. Thunder at 1¼, 3, 7 & 8 P. M. Lightning at 6½, 7 & 8 P. M. Rain at 3, 7 & 8 P. M.
22	136.0	...	E. by S. & E. S. E.	...	81.0	\\i to 5 A. M., \\i afterwards. Lightning to W. at 11 P. M.
23	118.5	0.21	S. E. & S. S. E.	...	127.1	Overcast to 9 A. M., straton to 3 P. M., overcast afterwards. Slight rain from 5 to 7 A. M. & 4 to 9 P. M.
24	...	1.20	S. E. & S. S. E.	1.0	188.2	Overcast to 4 P. M., straton afterwards. Lightning to W at 7 & 8 P. M. Rain from 3 A. M. to 1 P. M. & at 9½ P. M.
25	121.5	0.38	S. E., S. S. E. & S.	...	201.8	Chiefly straton. Slight rain at 1, 3, 7 & 12 A. M. & 2 & 5½ P. M.
26	...	...	S. by E. & S. S. E.	...	163.6	\\i to 6 A. M., straton afterwards. Drizzled at 8 & 11 A. M. and 6½ P. M.
27	132.0	...	S. S. E. & S.	...	161.4	Clear to 7 A. M., \\i to 6 P. M., clear afterwards. Drizzled at noon and 5½ P. M.

*Abstract of the Result of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1869.*

Solar Radiation, Weather, &c..

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	max. Pressure.	Daily Velocity.	
28	130.0	0.04	S. & S. by W.	...	147.9	Clear to 5 A. M. \i & \i to 6 P. M., clear afterwards. Lightning to W. at 6 & 8½ P. M. Slight rain at noon.
29	130.0	...	S by W, S. S. W. & S.	...	188.0	\i & \i to 6 P. M., clear afterwards. Lightning W at midnight and from 9 to 11 P. M. Drizzled at 2 A. M.
30	133.2	0.41	S, S. E. & S. by E.	1.0	149.6	Stratoni to 8 A. M., \i to 5 P. M., clouds of different kinds afterwards. Lightning to W at midnight and 8 P. M. Rain at 6 & 7½ P. M.

\i Cirri, — i Strati, \i Cumuli, \i Cirro-strati, \i Cumulo strati, \i Nimbi  
 \i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of September 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.691
Max. height of the Barometer occurred at 10 A. M. on the 30th.	29.841
Min. height of the Barometer occurred at 5 P. M. on the 2nd.	29.541
<i>Extreme range</i> of the Barometer during the month	0.300
Mean of the daily Max. Pressures	29.751
Ditto ditto Min. ditto	29.624
<i>Mean daily range</i> of the Barometer during the month	0.127

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	°
Mean Dry Bulb Thermometer for the month	83.1
Max. Temperature occurred at 2 P. M. on the 21st.	92.0
Min. Temperature occurred at 5, 6, & 7 A. M. on the 23rd & 24th.	78.0
<i>Extreme range</i> of the Temperature during the month	14.0
Mean of the daily Max. Temperature	88.0
Ditto ditto Min. ditto	80.0
<i>Mean daily range</i> of the Temperature during the month	8.0

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Mean Wet Bulb Thermometer for the month	80.4
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	2.7
Computed Mean Dew-point for the month	78.5
Mean Dry Bulb Thermometer above computed mean Dew-point	4.6

	Inches.
Mean Elastic force of Vapour for the month	0.955

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	Troy grain.
Mean Weight of Vapour for the month	10.25
Additional Weight of Vapour required for complete saturation	1.61
Mean degree of humidity for the month, complete saturation being unity	0.86

	°
Mean Max. Solar radiation Thermometer for the month	128.6

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	Inches.
Rained 26 days,—Max. fall of rain during 24 hours	1.88
Total amount of rain during the month	7.91
Total amount of rain indicated by the Gauge attached to the anemometer during the month	7.20
Prevailing direction of the Wind...	S, S. E. & S. E.

MONTHLY RESULTS.

Tables shewing the number of days on which at a given hour any particular wind blew, together with the number of days on which at the same hour, when any particular wind was blowing, it rained.

Hour.	N.	Rain on.	N. by E.	Rain on.	E. N. E.	Rain on.	E. by N.	Rain on.	E.	Rain on.	S. by S.	Rain on.	S. S. E.	Rain on.	S. S. E.	Rain on.	S. by E.	Rain on.	S.	Rain on.	S. by W.	Rain on.	S. S. W.	Rain on.	S. W.	Rain on.	W. S. W.	Rain on.	W. by S.	Rain on.	W.	Rain on.	W. by N.	Rain on.	W. N. W.	Rain on.	N. W.	Rain on.	N. N. W.	Rain on.	N. by W.	Rain on.					
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*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1869.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.789	29.865	29.720	0.145	84.2	90.0	79.8	10.2
2	.794	.850	.719	.131	83.9	90.5	80.5	10.0
3	.806	.879	.744	.135	83.8	90.6	80.0	10.6
4	.753	.824	.661	.163	84.6	90.4	79.8	10.6
5	.712	.781	.648	.133	85.1	90.0	80.5	9.5
6	.721	.789	.680	.109	84.5	89.5	81.0	8.5
7	.673	.750	.596	.154	83.2	89.6	77.7	11.9
8	.666	.756	.515	.241	80.4	82.6	77.5	5.1
9	.769	.833	.722	.111	82.3	86.3	79.4	6.9
10	.787	.855	.714	.141	83.4	89.0	79.3	9.7
11	.765	.826	.718	.108	83.6	89.0	80.0	9.0
12	.792	.867	.750	.117	83.5	89.3	80.0	9.3
13	.771	.835	.694	.141	83.6	89.0	78.6	10.4
14	.755	.806	.713	.093	83.2	88.6	79.0	9.6
15	.782	.839	.737	.102	82.6	87.6	78.5	9.1
16	.788	.853	.741	.112	82.3	87.5	77.0	10.5
17	.785	.844	.731	.113	80.8	84.5	79.2	5.3
18	.792	.858	.733	.125	79.2	83.5	77.0	6.5
19	.826	.886	.783	.103	79.1	84.5	77.4	7.1
20	.832	.887	.774	.113	80.9	87.5	77.0	10.5
21	.820	.871	.764	.107	81.0	85.5	76.8	8.7
22	.863	.912	.803	.109	80.5	87.2	78.2	9.0
23	.916	.978	.860	.118	80.9	87.0	76.4	10.6
24	.945	30.009	.883	.126	80.5	86.7	74.7	12.0
25	.900	29.962	.844	.118	79.5	84.4	74.5	9.9
26	.912	.974	.878	.096	79.7	84.7	75.8	8.9
27	.957	30.018	.917	.101	78.7	84.2	75.0	9.2
28	.957	.026	.915	.111	76.9	82.9	71.5	11.4
29	.937	.015	.893	.122	76.7	83.5	71.0	12.5
30	.909	29.973	.857	.116	77.1	84.5	71.2	13.3
31	.947	30.010	.889	.121	78.0	85.7	72.0	13.7

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	°	°	°	°	Inches.	T. gr.	T. gr.	
1	80.0	4.2	77.1	7.1	0.913	9.78	2.46	0.80
2	79.7	4.2	76.8	7.1	.905	.69	.44	.80
3	80.2	3.6	77.7	6.1	.931	.98	.12	.83
4	80.2	4.4	77.1	7.5	.913	.76	.63	.79
5	80.2	4.9	76.8	8.3	.905	.67	.90	.77
6	80.4	4.1	77.5	7.0	.925	.90	.45	.80
7	79.1	4.1	76.2	7.0	.887	.52	.37	.80
8	78.5	1.9	77.2	3.2	.916	.89	1.05	.90
9	80.0	2.3	78.4	3.9	.952	10.23	.35	.88
10	80.4	3.0	78.3	5.1	.949	.18	.78	.85
11	80.2	3.4	77.8	5.8	.934	.01	2.02	.83
12	80.2	3.3	77.9	5.6	.937	.04	1.96	.84
13	80.2	3.4	77.8	5.8	.934	.01	2.02	.83
14	78.7	4.5	75.5	7.7	.868	9.31	.58	.78
15	77.3	5.3	73.6	9.0	.817	8.77	.91	.75
16	76.7	5.6	72.8	9.5	.795	.54	3.04	.74
17	78.2	2.6	76.4	4.4	.893	9.64	1.43	.87
18	77.5	1.7	76.3	2.9	.890	.63	0.93	.91
19	77.2	1.9	75.9	3.2	.879	.51	1.02	.90
20	77.5	3.4	75.1	5.8	.857	.23	.87	.83
21	77.5	3.5	75.0	6.0	.854	.20	.94	.83
22	77.4	3.1	75.2	5.3	.860	.28	.70	.85
23	75.5	5.4	71.7	9.2	.768	8.28	2.82	.75
24	73.7	6.8	68.9	11.6	.701	7.55	3.43	.69
25	73.2	6.3	68.8	10.7	.699	.54	.12	.71
26	73.6	6.1	69.3	10.4	.711	.67	.05	.72
27	72.5	6.2	68.2	10.5	.686	.41	.00	.71
28	70.9	6.0	66.7	10.2	.653	.09	2.77	.72
29	70.4	6.3	66.0	10.7	.638	6.92	.88	.71
30	70.0	7.1	65.0	12.1	.617	.71	3.21	.68
31	70.1	7.9	64.6	13.4	.609	.60	.59	.65

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fah.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid- night.	29.823	29.956	29.569	0.387	79.2	82.5	73.2	9.3
1	.813	.949	.541	.408	79.0	82.0	73.0	9.0
2	.804	.945	.522	.423	78.6	81.8	72.5	9.3
3	.796	.947	.515	.432	78.3	81.6	72.0	9.6
4	.790	.942	.516	.426	77.9	81.5	71.8	9.7
5	.805	.955	.604	.351	77.7	81.0	71.5	9.5
6	.823	.978	.631	.347	77.5	81.0	71.0	10.0
7	.845	.995	.660	.335	78.4	82.5	71.4	11.1
8	.866	30.010	.700	.310	80.5	85.6	74.2	11.4
9	.883	.022	.750	.272	82.1	86.8	76.7	10.1
10	.882	.026	.741	.285	83.5	88.0	77.6	10.4
11	.867	.003	.720	.283	84.8	89.3	79.5	9.8
Noon.	.840	29.983	.693	.290	85.9	90.6	81.2	9.4
1	.811	.952	.661	.291	86.2	90.5	82.4	8.1
2	.787	.932	.624	.308	86.2	90.5	81.0	9.5
3	.775	.923	.602	.321	85.6	90.3	78.2	12.1
4	.771	.923	.596	.327	84.6	89.5	78.2	11.3
5	.776	.935	.597	.338	83.9	89.2	78.8	10.4
6	.787	.941	.607	.334	82.3	86.8	78.5	8.3
7	.803	.954	.629	.325	81.3	86.0	77.5	8.5
8	.823	.971	.619	.352	80.7	85.5	76.0	9.5
9	.837	.983	.620	.363	80.2	84.4	75.0	9.4
10	.841	.981	.611	.370	79.7	83.4	74.5	8.9
11	.837	.975	.583	.392	79.3	82.6	73.8	8.8

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb  
Thermometer Means are derived from the observations made at the several  
hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid- night.	76.9	2.3	75.3	3.9	0.862	9.32	1.24	0.88
1	76.8	2.2	75.3	3.7	.862	.32	.18	.89
2	76.6	2.0	75.2	3.4	.860	.31	.07	.90
3	76.4	1.9	75.1	3.2	.857	.28	.00	.90
4	76.2	1.7	75.0	2.9	.854	.25	0.91	.91
5	76.0	1.7	74.8	2.9	.849	.20	.90	.91
6	75.8	1.7	74.6	2.9	.843	.14	.90	.91
7	76.4	2.0	75.0	3.4	.854	.25	1.06	.90
8	76.9	3.6	74.4	6.1	.838	.04	.94	.82
9	77.2	4.9	73.8	8.3	.822	8.84	2.67	.77
10	77.5	6.0	73.3	10.2	.809	.66	3.34	.72
11	77.7	7.1	72.7	12.1	.792	.47	.99	.68
Noon.	77.8	8.1	72.1	13.8	.778	.29	4.58	.64
1	77.7	8.5	71.7	14.5	.768	.18	.81	.63
2	77.7	8.5	71.7	14.5	.768	.18	.81	.63
3	77.5	8.1	71.8	13.8	.771	.21	.55	.64
4	77.1	7.5	71.8	12.8	.771	.23	.16	.66
5	77.4	6.5	72.8	11.1	.795	.52	3.61	.70
6	77.3	5.0	73.8	8.5	.822	.82	2.76	.76
7	77.2	4.1	74.3	7.0	.835	.99	.25	.80
8	77.2	3.5	74.7	6.0	.846	9.12	1.92	.83
9	77.1	3.1	74.9	5.3	.851	.19	.69	.85
10	76.9	2.8	74.9	4.8	.851	.19	.53	.86
11	76.8	2.5	75.0	4.3	.854	.24	.35	.87

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
1	133.5	...	S. by E. & S.S.E.	...	87.9	\\i to 8 A. M., \\i to 6 P. M., clear afterwards. Drizzled at 5½ P. M.
2	133.4	...	E, S.E. & S. by E.	...	92.2	Chiefly \\i. Drizzled at 4 P. M.
3	134.0	...	S. by E, E. by S. & S.	...	132.0	Clear to 7 A. M., \\i to 6 P. M., clear afterwards. Thunder at 12½ A. M., & 2 P. M. Drizzled at 2½ P. M.
4	134.5	...	S. S. E., S. E. & S.	...	108.9	Clear to 8 A. M., \\i to 7 P. M., clear afterwards. Lightning to S. at 6¼ P. M.
5	131.8	...	S., S. E & S. S. E.	...	61.4	Clear to 7 A. M., \\i to 5 P. M., clear afterwards.
6	133.2	...	S. S. E. & S. E.	...	143.6	Clear to 6 A. M., \\i to 6 P. M., clear afterwards. Lightning to W. at 8 & 9 P. M.
7	133.0	0.20	E. & variable.	4.0	160.1	Clear to 5 A. M., \\i & \\i to 6 P. M., overcast afterwards. Brisk wind from 9 to 11 P. M., Rain at 7 & 11 P. M.
8	...	1.49	S. S. E. & S. E.	9.0	475.9	Overcast to 6 P. M., straton afterwords. Strong wind & rain from midnight to 5¼ A. M. Drizzled at 6 & 8 A. M., & at 3 P. M.
9	125.0	...	S. E. & S. S. E.	...	155.2	Stratoni to 5 A. M., \\i to 12 A. M., straton to 6 P. M., clear afterwards. Thunder at 11 and 12½ A. M. Lightning at 3 A. M. & 11 P. M. Drizzled at 3½ P. M.
10	134.0	0.04	S.S. E, & S. by E.	...	64.4	Clear to 6 A. M., \\i to 6 P. M., clear afterwards. Lightning at midnight & 1 A. M. & at 10 P. M., Slight rain at 2 P. M.
11	134.0	...	S. by E. & S. S. E.	...	54.8	Clear to 7 A. M., \\i to 4 P. M., clear afterwards. Drizzled at 2½ P. M.
12	131.0	...	S. S. E. & S. by W	...	56.2	\\i & \\i to 6 P. M., clear afterwards. Lightning to E at 7 P. M.
13	132.4	0.16	S. by W. & variable	...	63.0	\\i to 7 A. M., \\i to 6 P. M., overcast afterwards. Thunder at 8, 9 & 10 P. M. Lightning at 6, 7, 8, 9 & 10 P. M. Slight rain at 10½ A. M. & 4 P. M. & from 9 to 11 P. M.
14	131.5	...	S. W. & N. N. W.	...	77.0	Clouds of different kinds to 2 P. M., clear afterwards.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
15	131.5	...	E. N. E. & N. N. W.	...	70.8	Clear to 6 A. M., ☽ to 4 P. M., clear afterwards.
16	127.0	...	N by W. & N. W.	...	157.5	Clear to 9 A. M., ☾ afterwards.
17	130.4	0.46	N. E. & E. S. E.	...	164.9	Chiefly strati. Thunder at 2 & 3 P. M. Lightning to S. E. at 6½ P. M. Rain at 2¼ A. M., & 3 P. M.
18	...	0.21	N. N. E. & variable	...	92.9	☽ to 4 A. M., overcast to 2 P. M., strati afterwards. Thunder at 10 A. M., & 5 P. M. Slight rain from 6 to 11 A. M.
19	124.0	...	N. N. E. & E. by S.	...	83.4	Strati to 1 P. M., overcast to 5 P. M., ☾ & ☽ afterwards. Drizzled at 2½ & 4 P. M.
20	133.2	...	E. S. E. & S.	...	59.8	☽ & ☽
21	124.5	...	W. by S & E. N. E.	...	53.0	☽ to 7 A. M., ☽ to 2 P. M., strati afterwards.
22	130.4	0.47	E. N. E. N. E. & S. S. E.	...	94.3	☽ to 1 P. M., overcast to 6 P. M., clear afterwards. Thunder at 3 P. M. Rain at 5½ A. M. & 3 P. M.
23	124.6	...	E. N. E. & N. by W.	...	106.2	Clear to 11 A. M., ☽ to 4 P. M., clear afterwards.
24	127.0	...	N. N. E. & N. by W.	...	127.8	Chiefly clear.
25	122.0	...	N. by E. & W. N. W.	...	92.7	Chiefly clear.
26	...	...	W. N. W. & W. by N.	...	73.9	Clear to 2 A. M., ☽ to 10 A. M., ☽ to 5 P. M., clear afterwards.
27	...	...	W. by N & W. N. W.	...	50.8	Clear to 1 A. M., ☽ to 5 A. M., clear to 10 A. M., ☽ to 4 P. M., clear afterwards.
28	120.3	...	W. N. W. & W. by N.	...	54.0	Clear. Slightly foggy from 8 to 10 P. M.
29	121.5	...	W. by N. & W.	...	47.9	Clear to 10 A. M., ☽ to 4 P. M. clear afterwards.
30	120.0	...	W.	1.0	73.2	Clear. Slightly foggy at 7 & 8 P. M.
31	124.0	...	W. by S. & N.	0.8	80.7	Clear. Slightly foggy from 9 to 11 P. M.

☽ Cirri, — i Strati, ☽ Cumuli, ☽ Cirro-strati, ☽ Cumulo strati, ☽ Nimbi  
☽ Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of October 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.820
Max. height of the Barometer occurred at 10 A. M. on the 28th.	30.026
Min. height of the Barometer occurred at 3 A. M. on the 8th.	29.515
Extreme range of the Barometer during the month	0.511
Mean of the daily Max. Pressures	29.885
Ditto ditto Min. ditto	29.761
Mean daily range of the Barometer during the month	0.124

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	o
Mean Dry Bulb Thermometer for the month	81.4
Max. Temperature occurred at noon on the 3rd.	90.6
Min. Temperature occurred at 6 A. M. on the 29th.	71.0
Extreme range of the Temperature during the month	19.6
Mean of the daily Max. Temperature	87.0
Ditto ditto Min. ditto	77.3
Mean daily range of the Temperature during the month	9.7

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Mean Wet Bulb Thermometer for the month	77.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	4.4
Computed Mean Dew-point for the month	73.9
Mean Dry Bulb Thermometer above computed mean Dew-point	7.5

	Inches.
Mean Elastic force of Vapour for the month	0.824

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	Troy grain.
Mean Weight of Vapour for the month	8.87
Additional Weight of Vapour required for complete saturation	2.40
Mean degree of humidity for the month, complete saturation being unity	0.79

	o
Mean Max. Solar radiation Thermometer for the month	128.9

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	Inches.
Rained 13 days,—Max. fall of rain during 24 hours	1.49
Total amount of rain during the month	3.03
Total amount of rain indicated by the Gauge attached to the anemometer during the month	2.67
Prevailing direction of the Wind...	S. S. E. & variable.



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1869.*

Latitude  $22^{\circ} 33' 1''$  North. Longitude  $88^{\circ} 20' 34''$  East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at $32^{\circ}$ Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.972	30.038	29.929	0.109	77.4	84.9	70.5	14.4
2	.961	.035	.900	.135	75.8	82.9	69.8	13.1
3	.953	.038	.895	.143	74.5	82.0	69.0	13.0
4	.958	.027	.908	.119	72.7	80.4	65.5	14.9
5	.951	.021	.903	.118	72.1	79.7	65.2	14.5
6	.986	.053	.944	.109	72.4	80.0	65.5	14.5
7	30.019	.078	.981	.097	72.9	79.6	65.5	14.1
8	.038	.108	30.000	.108	73.3	81.2	66.0	15.2
9	.045	.124	29.993	.131	74.5	82.3	67.7	14.6
10	.034	.100	.983	.117	75.2	82.7	70.0	12.7
11	.046	.110	30.002	.108	75.7	82.7	69.4	13.3
12	.066	.145	.004	.141	75.4	82.6	69.5	13.1
13	.014	.085	29.947	.138	74.7	82.0	68.5	13.5
14	.001	.061	.947	.114	75.2	81.8	69.6	12.2
15	29.992	.063	.930	.133	75.6	84.0	69.0	15.0
16	.979	.048	.934	.114	76.1	84.3	69.0	15.3
17	.979	.049	.935	.114	75.1	82.0	70.0	12.0
18	.992	.069	.935	.134	72.6	80.2	66.0	14.2
19	30.017	.079	.979	.100	72.0	80.4	64.5	15.9
20	.012	.066	.955	.111	72.0	79.6	65.6	14.0
21	.018	.100	.965	.135	70.0	78.0	63.5	14.5
22	29.996	.068	.936	.132	69.0	77.5	62.0	15.5
23	30.008	.074	.950	.124	69.8	78.7	62.5	16.2
24	.047	.116	30.002	.114	71.7	79.7	63.5	16.2
25	.004	.062	29.919	.143	74.8	85.0	66.8	18.2
26	29.991	.080	.918	.162	73.6	82.5	65.5	17.0
27	.995	.075	.929	.146	72.5	81.5	64.0	17.5
28	.982	.065	.924	.141	71.4	79.6	64.7	14.9
29	.928	.010	.849	.161	70.4	80.5	62.2	18.3
30	.896	29.969	.843	.126	70.9	79.8	62.8	17.0

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	70.0	7.4	64.8	12.6	0.613	6.65	3.36	0.66
2	69.1	6.7	64.4	11.4	.605	.59	2.95	.69
3	66.1	8.4	60.2	14.3	.527	5.74	3.44	.63
4	64.3	8.4	57.6	15.1	.483	.28	.40	.61
5	64.9	7.2	59.1	13.0	.508	.56	2.97	.65
6	65.6	6.8	60.2	12.2	.527	.77	.83	.67
7	65.8	7.1	60.1	12.8	.525	.74	.99	.66
8	66.8	6.5	61.6	11.7	.552	6.02	.82	.68
9	68.6	5.9	64.5	10.0	.607	.62	.56	.72
10	69.2	6.0	65.0	10.2	.617	.73	.64	.72
11	69.1	6.6	64.5	11.2	.607	.61	.90	.70
12	67.6	7.8	62.1	13.3	.561	.11	3.32	.65
13	68.1	6.6	63.5	11.2	.588	.41	2.82	.69
14	69.2	6.0	65.0	10.2	.617	.73	.64	.72
15	69.9	5.7	65.9	9.7	.636	.92	.56	.73
16	69.4	6.7	64.7	11.4	.611	.65	.98	.69
17	67.9	7.2	62.9	12.2	.576	.18	3.06	.67
18	64.8	7.8	58.6	14.0	.499	5.46	.20	.63
19	65.1	6.9	59.6	12.4	.516	.66	2.84	.67
20	64.9	7.1	59.2	12.8	.509	.58	.92	.66
21	62.3	7.7	56.1	13.9	.459	.05	.95	.63
22	62.0	7.0	56.4	12.6	.464	.10	.66	.66
23	63.9	5.9	59.2	10.6	.509	.60	.35	.70
24	65.3	6.4	60.2	11.5	.527	.77	.66	.68
25	67.2	7.6	61.9	12.9	.557	6.07	3.19	.66
26	65.2	8.4	59.3	14.3	.511	5.58	.35	.63
27	64.5	8.0	58.1	14.4	.491	.38	.25	.62
28	64.0	7.4	58.1	13.3	.491	.39	2.96	.65
29	63.4	7.0	57.8	12.6	.486	.34	.76	.66
30	64.5	6.4	59.4	11.5	.513	.62	.61	.68

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid- night.	29.998	30.070	29.895	0.175	70.1	75.2	64.0	11.2
1	.991	.066	.895	.171	69.4	74.8	63.5	11.3
2	.985	.063	.889	.174	68.8	73.4	63.0	10.4
3	.978	.058	.882	.176	68.3	72.8	63.0	9.8
4	.975	.055	.874	.181	67.7	71.5	62.8	8.7
5	.987	.074	.883	.191	67.1	71.5	62.5	9.0
6	30.003	.090	.893	.197	66.6	70.5	62.0	8.5
7	.024	.106	.908	.198	66.7	71.0	62.4	8.6
8	.046	.132	.937	.195	69.5	75.3	65.0	10.3
9	.065	.145	.969	.176	72.8	77.6	68.5	9.1
10	.065	.133	.965	.168	75.7	80.0	71.3	8.7
11	.044	.122	.946	.176	78.1	81.7	73.9	7.8
Noon.	.015	.079	.919	.160	79.3	83.1	75.5	7.6
1	29.981	.042	.880	.162	80.3	84.5	76.4	8.1
2	.958	.022	.856	.166	81.1	85.0	77.4	7.6
3	.945	.008	.843	.165	81.0	84.8	77.5	7.3
4	.945	.005	.846	.159	79.6	84.5	76.0	8.5
5	.952	.017	.849	.168	78.4	83.0	74.8	8.2
6	.961	.027	.856	.171	76.1	80.2	72.0	8.2
7	.977	.047	.869	.178	74.7	77.8	70.2	7.6
8	.993	.068	.889	.179	73.4	76.5	68.8	7.7
9	30.003	.076	.910	.166	72.3	76.2	67.2	9.0
10	.009	.083	.932	.151	71.5	76.0	66.0	10.0
11	.004	.077	.913	.164	70.6	74.0	65.2	8.8

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid- night.	65.9	4.2	62.5	7.6	0.568	6.25	1.78	0.78
1	65.4	4.0	62.2	7.2	.563	.20	.66	.79
2	65.0	3.8	62.0	6.8	.559	.16	.55	.80
3	64.5	3.8	61.5	6.8	.550	.07	.53	.80
4	64.2	3.5	61.4	6.3	.548	.07	.39	.81
5	63.8	3.3	61.2	5.9	.544	.03	.29	.82
6	63.5	3.1	61.0	5.6	.541	5.99	.22	.83
7	63.6	3.1	61.1	5.6	.543	6.01	.22	.83
8	64.9	4.6	61.2	8.3	.544	.00	.88	.76
9	66.0	6.8	60.6	12.2	.534	5.84	2.87	.67
10	67.1	8.6	61.1	14.6	.543	.90	3.61	.62
11	67.6	10.5	60.2	17.9	.527	.70	4.52	.56
Noon.	67.6	11.7	59.4	19.9	.513	.53	5.06	.52
1	67.9	12.4	59.2	21.1	.509	.49	.42	.50
2	67.9	13.2	58.7	22.4	.501	.39	.78	.48
3	67.7	13.3	58.4	22.6	.496	.32	.82	.48
4	67.3	12.3	58.7	20.9	.501	.40	.29	.51
5	67.6	10.8	60.0	18.4	.523	.66	4.65	.55
6	68.3	7.8	62.8	13.3	.574	6.24	3.39	.65
7	68.1	6.6	63.5	11.2	.588	.41	2.82	.69
8	67.5	5.9	62.8	10.6	.574	.27	.60	.71
9	67.0	5.3	62.8	9.5	.574	.28	.30	.73
10	66.6	4.9	62.7	8.8	.572	.27	.11	.75
11	66.2	4.4	62.7	7.9	.572	.29	1.86	.77

All the Hygrometrical elements are computed by the Greenwich Constants.

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taken at the Surveyor General's Office, Calcutta,  
in the month of November 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
1	125.0	...	N.N.E. & W by N	...	47.5	Clear. Slightly foggy at 10 P. M.
2	119.5	...	W. by N. & W.	...	63.5	Clear.
3	118.3	...	W. & W. by S.	...	39.5	Clear. Slightly foggy from 4 to 8 P. M.
4	120.5	...	W.S.W. & W. by S.	...	52.5	Clear. Slightly foggy from 8 to 10 P. M.
5	120.0	...	W. by S, & S. W	...	19.9	Clear. Slightly foggy at 7 A. M. & 6 P. M.
6	117.0	...	S. W. & W.	...	9.8	Clear. Slightly foggy at 7 A. M. & 7 P. M.
7	119.0	...	W by N & W.S. W.	...	52.9	Clear.
8	121.0	...	W. S. W.	...	53.8	Clear. Slightly foggy at 7 & 8 P. M.
9	120.0	...	W.S.W.	...	67.5	Clear to 8 A. M. \i afterwards.
10	121.3	...	S.S. W & N.N.W.	...	56.4	Clear to 5 A.M. \i to 11 A.M. \i to 5 P. M., clear afterwards.
11	119.5	...	W. by N. & W.	...	73.5	Clear to 10 A. M. \i afterwards. Slightly foggy at 9 P.M.
12	122.0	...	W by N. & N.N.W. [by N.	...	117.4	Clear to noon. \i to 6 P. M. clear afterwards.
13	122.0	...	N by W, E.N.E & E.	...	177.2	Clear to 6 A. M. \i to 5 P. M., clear afterwards.
14	124.0	...	E. by N, ENE & S.E	...	50.0	Clear to 4 A. M. \i to 5 P.M., clear afterwards. Slightly foggy at 8 P. M.
15	120.0	...	S.E. & S. by E.	...	55.0	Clear to 10 A. M. \i & \i to 4 P. M. clear to 8 P.M. \i afterwards. Foggy from 7 to 11 P.M.
16	122.7	...	S, S.W. & W. by N.	...	79.9	Clear to 10 A.M. \i to 3 P.M. \i afterwards.
17	122.5	...	N. by E. & N. by W.	...	168.2	Chiefly clear.
18	117.2	...	E.N.E. & N.N.W.	...	124.4	Clear.
19	116.5	...	N. N.W. & N by W.	...	134.1	Clear. Slightly foggy at 8 & 9 P. M.
20	118.0	...	N. by W. & N.N.W.	...	179.7	Clear to 11 A. M. \i to 2 P. M. clear afterwards.
21	115.0	...	N.W. & W. by N.	...	135.2	Clear. Foggy at 10 P.M.
22	119.0	...	W N.W & W. by N.	...	95.8	Clear. Slightly foggy from 7 to 10 P. M.
23	116.5	...	W. N. W.	...	111.3	Clear to 11 A. M. \i to 5 P.M. clear afterwards. Slightly foggy at 5 & 6 A. M.
24	115.5	...	WNW, W & N by E	...	106.0	Clear to noon \i to 8 P. M. \i afterwards.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1869.*

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Gauge 1 $\frac{1}{4}$ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
25	119.5	...	N.byE, & N.N.E.	...	151.8	∩i & ∩i to 8 A. M., clear to noon ∩i & ∩i to 5 P. M. clear afterwards.
26	122.6	...	N. N. E. & N.	...	207.5	Clear.
27	119.8	...	N. by W. & N.	...	166.5	Clear to 5 A. M. ∩i & ∩i to 4 P. M., clear afterwards.
28	115.0	...	N.N.E.&W.N.W.	...	135.6	Clear.
29	116.8	...	W. N. W. & N.	...	93.7	Clear. Slightly foggy from 6 to 10 P. M.
30	118.0	...	N,NNW.&WbyE	...	54.9	Clear. Slightly foggy from 6 to 9 P. M,

∩i Cirri, — i Strati, ∩i Cumuli, ∩i Cirro-strati, ~i Cumulo strati, ~i Nimbi  
∩i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of November 1869.*

MONTHLY RESULTS.

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	Inches.
Mean height of the Barometer for the month...	29.996
Max. height of the Barometer occurred at 9 A. M. on the 12th.	30.145
Min. height of the Barometer occurred at 3 P. M. on the 30th.	29.843
Extreme range of the Barometer during the month	0.302
Mean of the daily Max. Pressures	30.067
Ditto ditto Min. ditto	29.941
Mean daily range of the Barometer during the month	0.126

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	°
Mean Dry Bulb Thermometer for the month	73.3
Max. Temperature occurred at 2 P. M. on the 25th.	85.0
Min. Temperature occurred at 6 A. M. on the 22nd.	62.0
Extreme range of the Temperature during the month	23.0
Mean of the daily Max. Temperature	81.3
Ditto ditto Min. ditto	66.4
Mean daily range of the Temperature during the month	14.9

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Mean Wet Bulb Thermometer for the month	66.3
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	7.0
Computed Mean Dew-point for the month	60.7
Mean Dry Bulb Thermometer above computed mean Dew-point	12.6

	Inches.
Mean Elastic force of Vapour for the month	0.536

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	Troy grain.
Mean Weight of Vapour for the month	5.84
Additional Weight of Vapour required for complete saturation	3.00
Mean degree of humidity for the month, complete saturation being unity	0.66

	°
Mean Max. Solar radiation Thermometer for the month	119.5

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	Inches.
Rained No days,—Max. fall of rain during 24 hours	Nil
Total amount of rain during the month	Nil
Total amount of rain indicated by the Gauge attached to the anemometer during the month	Nil
Prevailing direction of the Wind	W. by N. & W. N. W.



*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1869.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Date.	Mean Height of the Barometer at 32° Fahr.	Range of the Barometer during the day.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture during the day.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
1	29.908	29.989	29.837	0.152	71.5	79.5	66.0	13.5
2	.891	.976	.834	.142	70.7	79.5	63.4	16.1
3	.889	.957	.832	.125	69.7	78.0	63.0	15.0
4	.899	.977	.840	.137	68.0*	77.4	61.5	15.9
5	.918	.988	.871	.117	67.8	78.6	59.6	19.0
6	.937	30.019	.879	.140	67.6	77.5	60.0	17.5
7	.969	.055	.914	.141	67.5	76.7	59.5	17.2
8	.985	.049	.918	.131	69.4	78.7	61.5	17.2
9	.980	.052	.919	.133	69.5	77.7	62.7	15.0
10	.993	.082	.945	.137	68.8	77.5	61.0	16.5
11	30.014	.088	.947	.141	69.5	79.3	61.5	17.8
12	.010	.099	.948	.151	69.5	79.3	61.6	17.7
13	.031	.101	.985	.116	69.2	78.6	61.0	17.6
14	.043	.118	.996	.122	68.3	76.7	61.0	15.7
15	.019	.103	.946	.157	67.6	77.2	60.4	16.8
16	29.964	.047	.907	.140	66.8	76.0	58.8	17.2
17	.960	.043	.908	.135	68.5	78.9	59.8	19.1
18	.950	.006	.902	.104	68.3	77.5	60.5	17.0
19	30.005	.075	.970	.105	67.5	76.2	60.5	15.7
20	.019	.092	.979	.113	68.4	76.4	60.8	15.6
21	.008	.079	.967	.112	71.6	79.4	67.3	12.1
22	.028	.103	.983	.120	71.0	79.2	64.1	15.1
23	.056	.137	30.002	.135	69.0	77.0	62.4	14.6
24	.055	.134	.005	.129	68.0	77.0	61.2	15.8
25	.049	.124	29.997	.127	68.1	78.0	60.0	18.0
26	.044	.117	30.001	.116	69.0	78.8	60.5	18.3
27	.036	.102	29.986	.116	68.4	77.0	62.2	14.8
28	.053	.139	.996	.143	68.0	77.4	61.4	16.0
29	.043	.122	.975	.147	68.3	77.6	62.1	15.5
30	.028	.118	.963	.155	64.6	74.4	56.8	17.6
	.014	.086	.957	.129	64.1	74.0	57.2	16.8

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made during the day.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1869.*

Daily Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Date.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satu- ration being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
1	66.9	4.6	63.2	8.3	0.582	6.39	1.99	0.76
2	64.7	6.0	59.9	10.8	.521	5.72	2.46	.70
3	63.4	6.3	58.4	11.3	.496	.46	.47	.69
4	61.2	6.8	55.8	12.2	.455	.03	.50	.67
5	60.8	7.0	55.2	12.6	.445	4.92	.56	.66
6	60.5	7.1	54.8	12.8	.440	.85	.59	.65
7	61.2	6.3	56.2	11.3	.461	5.10	.32	.69
8	63.4	6.0	58.6	10.8	.499	.50	.36	.70
9	63.2	6.3	58.2	11.3	.493	.43	.45	.69
10	62.9	5.9	58.2	10.6	.493	.43	.28	.70
11	63.4	6.1	58.5	11.0	.493	.48	.40	.70
12	62.6	6.9	57.1	12.4	.475	.23	.65	.66
13	62.2	7.0	56.6	12.6	.467	.14	.67	.66
14	61.6	6.7	56.2	12.1	.461	.08	.52	.67
15	60.5	7.1	54.8	12.8	.440	4.85	.59	.65
16	60.1	6.7	54.7	12.1	.438	.85	.41	.67
17	61.8	6.7	56.4	12.1	.464	5.11	.54	.67
18	61.1	7.2	55.3	13.0	.447	4.94	.66	.65
19	61.4	6.1	56.5	11.0	.465	5.14	.28	.69
20	62.7	5.7	58.1	10.3	.491	.42	.20	.71
21	63.1	5.5	61.7	9.9	.554	6.07	.33	.72
22	65.7	5.3	61.5	9.5	.550	.04	.21	.73
23	61.7	7.3	55.9	13.1	.456	5.03	.73	.65
24	60.8	7.2	55.0	13.0	.442	4.89	.64	.65
25	62.4	5.7	57.8	10.3	.486	5.37	.18	.71
26	62.7	6.3	57.7	11.3	.485	.34	.42	.69
27	61.9	6.5	56.7	11.7	.469	.16	.46	.68
28	60.3	7.7	54.1	13.9	.429	4.74	.79	.63
29	60.6	7.7	54.4	13.9	.434	.78	.82	.63
30	56.7	7.9	50.4	14.2	.379	.22	.56	.62
31	56.5	7.6	49.7	14.4	.370	.12	.55	.62

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.

Hour.	Mean Height of the Barometer at 32° Fah.	Range of the Barometer for each hour during the month.			Mean Dry Bulb Thermometer.	Range of the Tempera- ture for each hour during the month.		
		Max.	Min.	Diff.		Max.	Min.	Diff.
	Inches.	Inches.	Inches.	Inches.	o	o	o	o
Mid- night.	29.992	30.054	29.886	0.168	65.1	69.8	59.8	10.0
1	.985	.048	.881	.167	64.4	69.0	59.0	10.0
2	.979	.042	.880	.162	63.8	68.5	58.8	9.7
3	.973	.037	.877	.160	63.1	67.4	58.4	9.0
4	.969	.042	.871	.171	62.5	67.4	58.2	9.2
5	.979	.058	.875	.183	62.0	67.3	57.5	9.8
6	.993	.078	.887	.191	61.5	67.3	57.0	10.3
7	30.013	.087	.899	.188	61.4	67.4	56.8	10.6
8	.041	.114	.936	.178	63.3	68.5	58.8	9.7
9	.065	.134	.954	.180	66.5	70.5	61.5	9.0
10	.069	.139	.957	.182	70.3	73.5	64.5	9.0
11	.050	.114	.943	.171	73.4	76.4	68.5	7.9
Noon.	.019	.085	.911	.174	75.3	78.0	70.2	7.8
1	29.985	.052	.875	.177	76.6	78.8	72.0	6.8
2	.959	.021	.851	.170	77.5	79.5	73.3	6.2
3	.944	.006	.834	.172	77.5	79.5	74.0	5.5
4	.940	.011	.832	.179	76.2	78.5	72.0	6.5
5	.947	.023	.839	.184	74.7	77.0	70.7	6.3
6	.953	.030	.845	.185	71.9	74.8	68.0	6.8
7	.975	.041	.863	.178	70.1	73.0	66.0	7.0
8	.991	.057	.880	.177	68.5	71.5	63.5	8.0
9	30.004	.068	.894	.174	67.3	70.5	63.0	7.5
10	.009	.072	.899	.173	66.3	69.5	61.5	8.0
11	.003	.059	.890	.169	65.4	68.8	60.0	8.8

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb  
Thermometer Means are derived from the observations made at the several  
hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1869.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements  
dependent thereon.—(Continued.)

Hour.	Mean Wet Bulb Ther- mometer.	Dry Bulb above Wet.	Computed Dew Point.	Dry Bulb above Dew Point.	Mean Elastic force of Vapour.	Mean Weight of Vapour in a Cubic foot of air.	Additional Weight of Vapour required for complete saturation.	Mean degree of Humi- dity, complete satura- tion being unity.
	o	o	o	o	Inches.	T. gr.	T. gr.	
Mid- night.	61.2	3.9	58.1	7.0	0.491	5.45	1.44	0.79
1	60.7	3.7	57.4	7.0	.480	.33	.41	.79
2	60.2	3.6	57.0	6.8	.473	.27	.34	.80
3	59.7	3.4	56.6	6.5	.467	.21	.26	.81
4	59.3	3.2	56.4	6.1	.464	.18	.17	.82
5	58.8	3.2	55.9	6.1	.456	.10	.15	.82
6	58.5	3.0	55.8	5.7	.455	.09	.07	.83
7	58.4	3.0	55.7	5.7	.453	.07	.07	.83
8	59.6	3.7	56.3	7.0	.462	.16	.35	.79
9	61.2	5.3	57.0	9.5	.473	.23	.96	.73
10	63.0	7.3	57.2	13.1	.476	.23	2.85	.65
11	63.8	9.6	66.1	17.3	.459	.02	3.85	.57
Noon.	64.1	11.2	56.3	19.0	.462	.03	4.37	.54
1	64.4	12.2	55.9	20.7	.456	4.94	.83	.51
2	64.7	12.8	55.7	21.8	.453	.90	5.14	.49
3	64.3	13.2	55.1	22.4	.444	.82	.22	.48
4	63.8	12.4	55.1	21.1	.444	.83	4.83	.50
5	64.2	10.5	56.8	17.9	.470	5.12	.11	.56
6	64.6	7.3	53.8	13.1	.503	.50	2.98	.65
7	63.9	6.2	58.9	11.2	.504	.55	.48	.69
8	63.2	5.3	59.0	9.5	.506	.53	.07	.73
9	62.4	4.9	53.5	8.8	.498	.50	1.87	.75
10	61.8	4.5	58.2	8.1	.493	.46	.69	.76
11	61.2	4.2	57.8	7.6	.486	.39	.56	.78

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1869.  
Solar Radiation, Weather, &c.*

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure.	Daily Velocity.	
	°	Inches		lb	Miles	
1	120.0	...	W.byN.&W.byS.	...	21.3	Clear to 10 A. M. \i & \i to 2 P. M. clear afterwards. Foggy from 6 to 9 A. M.
2	118.5	...	W.byS.&W.byN.	...	48.4	Clear.
3	116.5	...	W.byN.&W.N.W	...	76.4	Clear.
4	113.5	...	W. N. W.	...	100.0	Clear to 2 P. M. \i to 5 P. M., clear afterwards.
5	116.5	...	W. N. W. & W.	...	96.0	Clear to 6 A. M. \i to 3 P. M. \i to 6 P. M. clear afterwards. Slightly foggy at 4 & 5 A. M. & from 6 to 11 P. M.
6	116.5	...	[W. N. W. S.W., W. S. W. &	...	50.2	Clear. Slightly foggy from 4 to 6 A. M.
7	110.0	...	WNW.&N.N.W.	...	63.7	Clear. Slightly foggy from 3 to 6 A. M.
8	112.8	...	N.N.W. & N.N.E.	...	92.1	Clear.
9	113.0	...	N.N.E.&W.byN.	...	107.7	Clear. Slightly foggy from 7 to 11 P. M.
10	111.2	...	W.	...	51.0	Clear. Slightly foggy from midnight to 7 A.M. & 7 to 11 P.M.
11	115.2	...	W,N.E.&N.by E.	...	49.3	Clear. Slightly foggy at midnight & 1 & from 5 to 7 A.M. & 7 to 11 P. M.
12	114.0	...	E.N.E. & N.by E. [N. by E.	...	100.6	Clear. Slightly foggy from 8 to 11 P. M.
13	112.5	...	E. N. E, N. N. E. &	...	116.6	Clear.
14	112.6	...	N by E, N.E. & N.	...	158.7	Clear to 8 A. M. \i afterwards.
15	112.0	...	N. by W. & N.W.	1.6	114.0	Clear. Foggy at 10 & 11 P. M.
16	112.0	...	N.W. & W. by S.	...	89.6	Clear. Slightly, foggy at midnight & from 7 to 11 P. M.
17	113.5	...	W.byS&W.N.W.	...	79.1	Chiefly clear. Foggy from 7 to 11 P. M.
18	115.0	...	W.S.W.&WbyN.	...	94.3	Clear. Foggy from 7 to 11 P.M.
19	114.0	...	WbyN.&W.N.W	...	74.2	Clear. Foggy from midnight to 6 A. M. & at 11 P. M.
20	111.0	...	W.byN.&N.W.	...	83.8	Clear to 8 A. M. \i afterwards. Foggy at 7 A. M.
21	115.0	...	N. W. & W. S. W.	...	44.0	\i & \i to 7 A. M. \i to 5 P. M. clear afterwards. Slightly foggy from 5 to 8 A M. & 7 to 9 P. M.
22	113.0	...	W.S.W&N.N.W.	...	69.9	Chiefly clear.
23	112.0	...	N, N. E. & N.	...	178.1	Clear.
24	116.0	...	N,NbyE&NbyW.	1.2	163.2	Clear.
25	115.3	...	NbyW,WNW&N	...	95.2	Clear.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1869.*

Solar Radiation, Weather, &c.

Date.	Max. Solar radiation.	Rain Gauge 1½ ft. above Ground.	WIND.			General aspect of the Sky.
			Prevailing direction.	Max. Pressure	Daily Velocity.	
	°	Inches		lb	Miles	
26	114.5	...	N. & N. N. E.	...	189.2	Clear.
27	115.5	...	N. N. E.	...	88.9	Clear.
28	112.5	...	N. N. E.	...	154.5	Clear. Slightly foggy from 6 to 11 P. M.
29	114.8	...	NNE, N & N. by W.	...	164.4	Clear.
30	114.5	...	N. & N. by W.	...	144.2	Clear to 3 A. M. \i to 6 P. M clear afterwards.
31	114.5	...	N, by E. & N.W.	...	118.7	Chiefly clear.

\i Cirri. — i Strati, \i Cumuli, \i Cirro-strati, ~i Cumulo strati, ~i Nimbi  
~i Cirro cumuli.

*Abstract of the Results of the Hourly Meteorological Observations  
taken at the Surveyor General's Office, Calcutta,  
in the month of December 1869.*

MONTHLY RESULTS.

	Inches.
Mean height of the Barometer for the month...	29.993
Max. height of the Barometer occurred at 10 A. M. on the 28th.	30.139
Min. height of the Barometer occurred at 4 P. M. on the 3rd.	29.832
Extreme range of the Barometer during the month	0.307
Mean of the daily Max. Pressures	30.070
Ditto ditto Min. ditto	29.939
Mean daily range of the Barometer during the month	0.131

	°
Mean Dry Bulb Thermometer for the month	68.5
Max. Temperature occurred at 2 & 3 P. M. on the 1st & 2nd.	79.5
Min. Temperature occurred at 7 A. M. on the 30th.	56.8
Extreme range of the Temperature during the month	22.7
Mean of the daily Max. Temperature	77.6
Ditto ditto Min. ditto	61.3
Mean daily range of the Temperature during the month	16.3

Mean Wet Bulb Thermometer for the month	62.0
Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer	6.5
Computed Mean Dew-point for the month	56.8
Mean Dry Bulb Thermometer above computed mean Dew-point	11.7

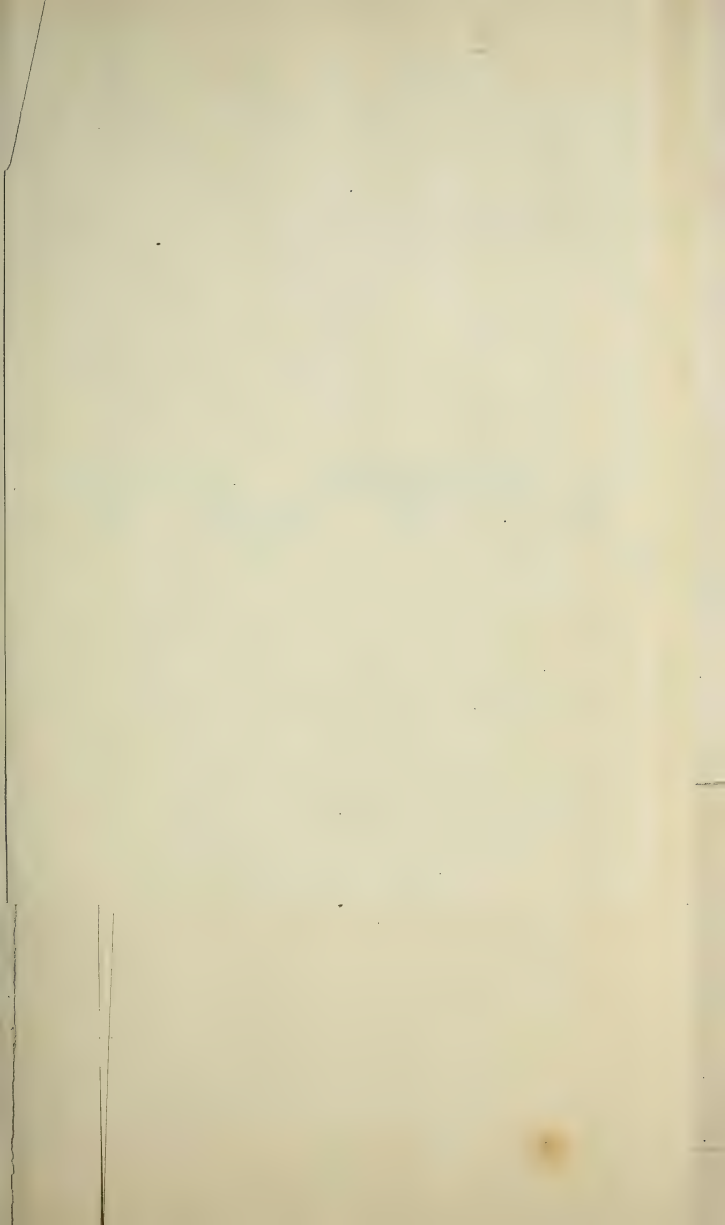
	Inches.
Mean Elastic force of Vapour for the month	0.470

	Troy grain.
Mean Weight of Vapour for the month	5.18
Additional Weight of Vapour required for complete saturation	2.47
Mean degree of humidity for the month, complete saturation being unity	0.68

	°
Mean Max. Solar radiation Thermometer for the month	114.1

	Inches.
Rained no days,—Max. fall of rain during 24 hours	Nil
Total amount of rain during the month	Nil
Total amount of rain indicated by the Gauge attached to the anemometer during the month	Nil
Prevailing direction of the Wind	N.N.E., W. by N. & W.N.W.









Hour.	S.	Rain on.	N. by E.	Wain on.	N. N. E.	Wain on.	N. N. W.	Rain on.
11	4	1	1	1	1	1	1	1
10	3	1	1	1	1	1	1	1
9	3	1	1	1	1	1	1	1
8	3	1	1	1	1	1	1	1
7	3	1	1	1	1	1	1	1
6	3	1	1	1	1	1	1	1
5	3	1	1	1	1	1	1	1
4	3	1	1	1	1	1	1	1
3	3	1	1	1	1	1	1	1
2	3	1	1	1	1	1	1	1
1	3	1	1	1	1	1	1	1
Mid night	5	1	1	1	1	1	1	1

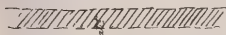




## SECTION (b) in scarp under NONKERASI



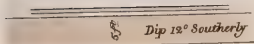
On the highest point of the hill the rock was a light fine grained sandstone



Coarse Sandstone

Another bed of coaly stuff must occur about this point following up the ravine on the hard surface of the sand stone traces of pieces of coal were seen but the jungle is so thick I could not penetrate further, the pieces were very inferior in quality

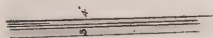
These shales were light dove coloured very thin bedded, speckled and dotted throughout with dark spots of vegetable matter; the remains so altered as to show no structure under a low power



Dip 12° Southerly

Carbonaceous shales same as those at Landekar (?) in appearance may be of same age Very hard compact sandstone like that of Cherra & holding precisely the same topographical position on the surface of the country.

The hill running back nearly level from this point Red and purple coarse sandstones.



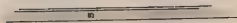
Black Earthy Shale 1 1/2 } Coal Bed No 4

3' 4"

50 feet

Sandstones fine white & coarse gritty

8' 0"

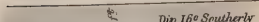


20 feet

Coal Bed No 3 upper 3 inches a band distinctly stratified being hard heavy and compact. Upper part fine light coloured sands and soft shales with small black particles of vegetable matter. above the coal was 4 inches of white and pinkish shale then 4 in. band of dark carbonaceous matter.

Coal Bed No 2 the portions on surface are lighter in weight evidently due to exposure; bedding very regular under and upper surfaces true planes Coarse white gritty sandstone (quartz) with a few small discolorations here and there.

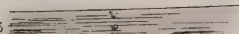
8' 0"



15 feet

} Coal Bed No 1

6' 0"



Total of Bed 20' 4"

Sandstones red ferruginous tinted coarse sand





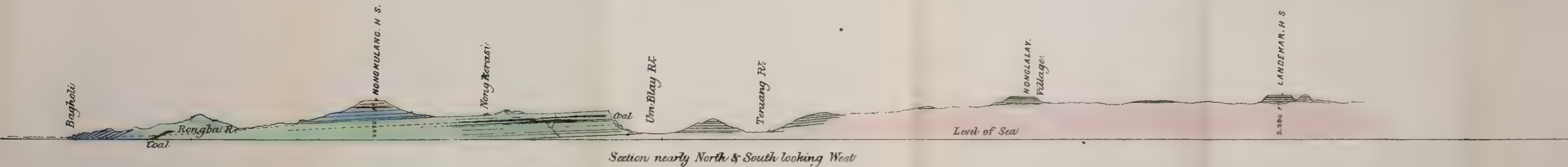


# WEST KHASI HILLS

SECTION A. FROM LANDEKAR H.S. TO THE PLAINS AT BAGHOLI.

Scale: one inch = one Mile.

Scale of Heights in feet

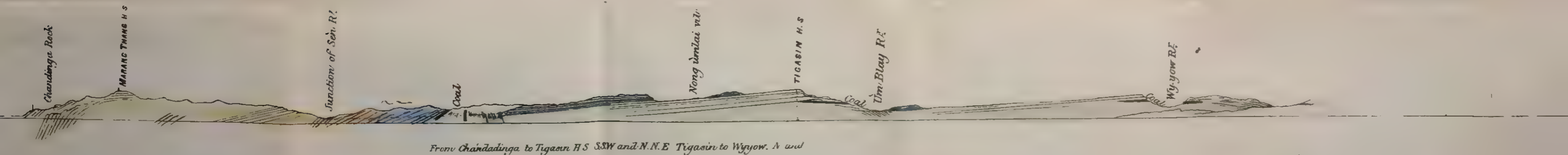


- Granuloid Rocks
- Infra Nummulitic
- Nummulitic Limestone.
- Supra Nummulitic
- Tertiary

SECTION B. FROM WYOW RIVER TO PLAINS AT CHANDADINGA. MYMENSING DISTRICT.

SOUTH

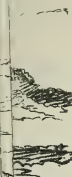
NORTH.



*W. G. Anderson - Secy*  
Lumsden



ate IV.







Photosinco. at the Surveyor General's Office, Calcutta,  
February 1868.

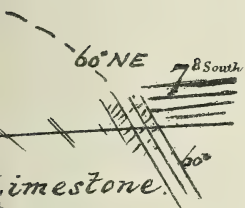
Journal As. Soc. Bengal, Vol. XXXVIII Pt. II.



Photosinco. at the Surveyor General's Office, Calcutta,  
February 1868.



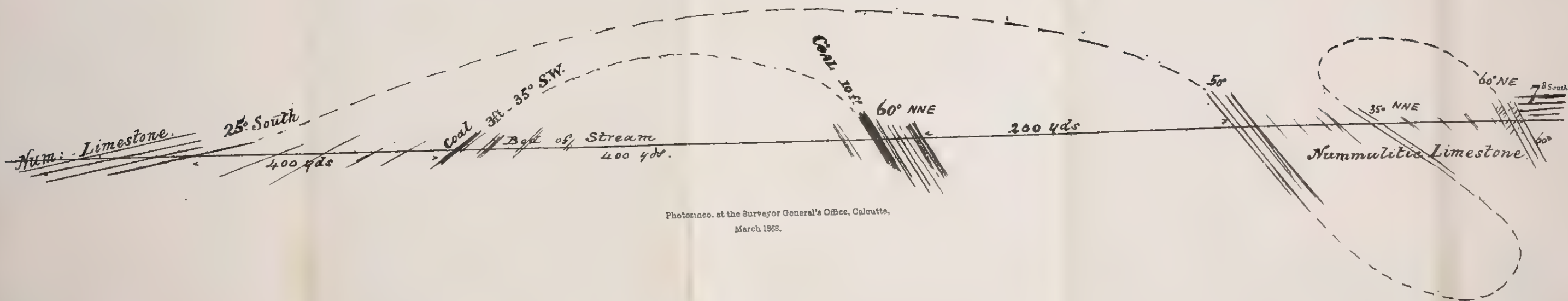
V.



*Edward C. C. C.*  
*m*



# WEST KHASI HILLS. SECTION IN THE UM-DURLIANG RIVER. (C).

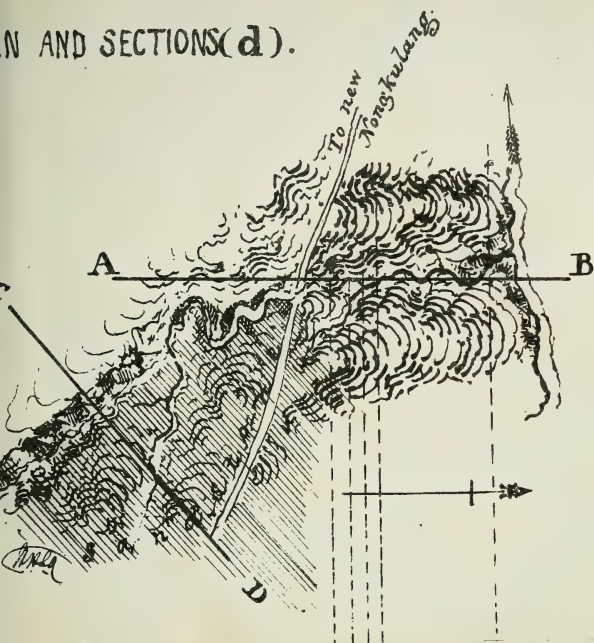


Photomicro. at the Surveyor General's Office, Calcutta,  
March 1868.

*W. P. Godwin*  
*Surveyor*

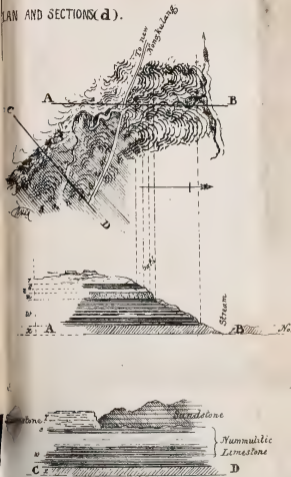


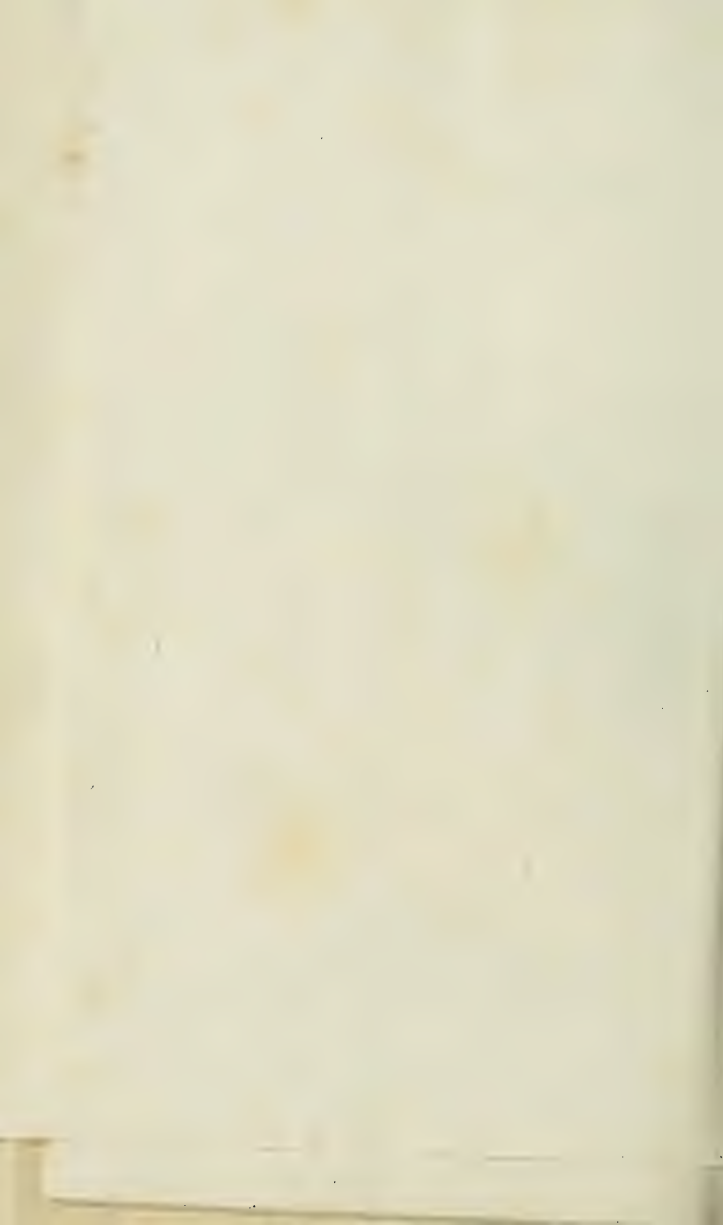
# N AND SECTIONS(d).





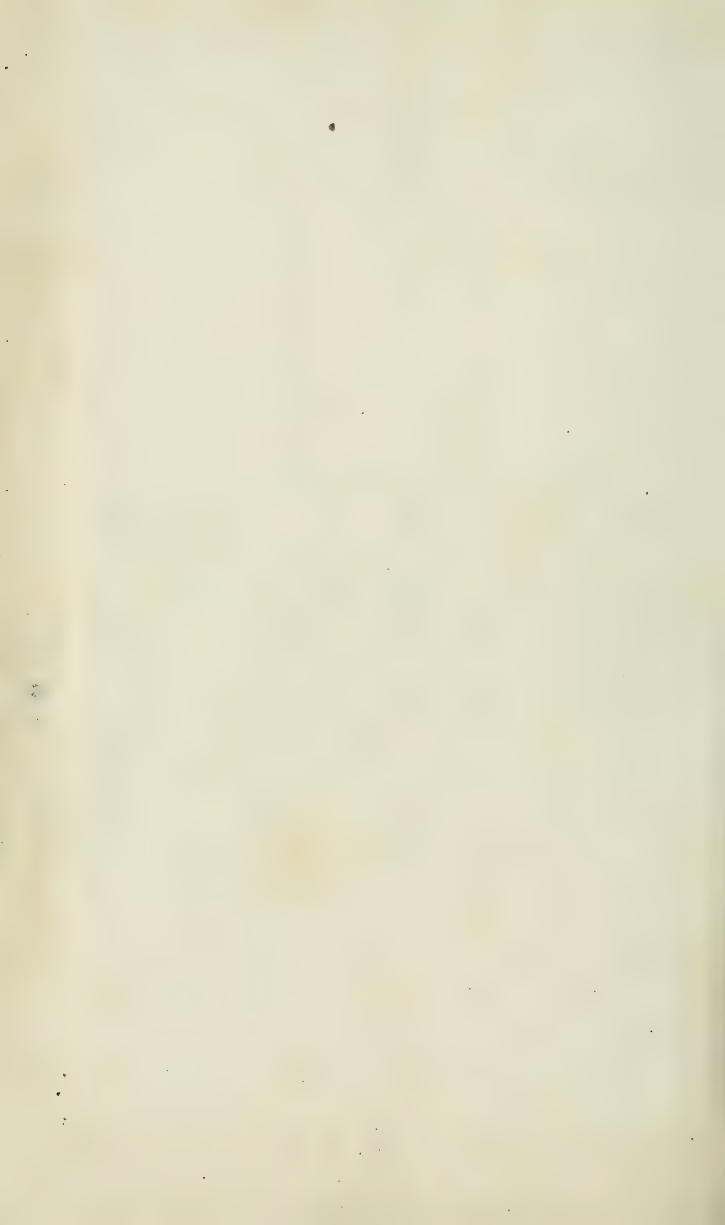
# PLAN AND SECTIONS (d).







Photozinc. at the Surveyor General's Office, Calcutta,  
March 1868.



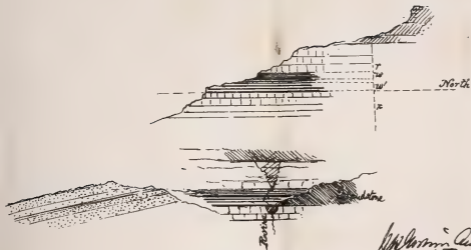
Journ

Plate VIII.



*Handwritten signature or initials, possibly 'H. C. W.' or similar, in cursive script.*

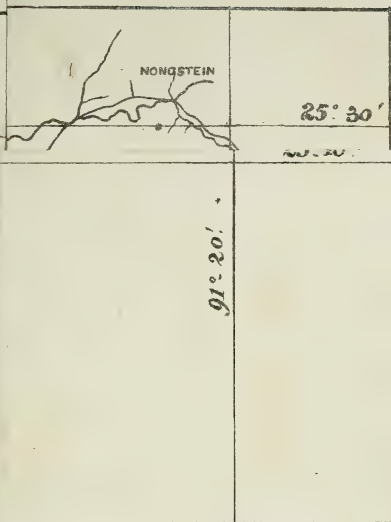




Photostereo. at the Surveyor General's Office, Calcutta,  
March 1868.

W. H. Murray  
Surveyor General





OF T  
IRVEYE

Phot

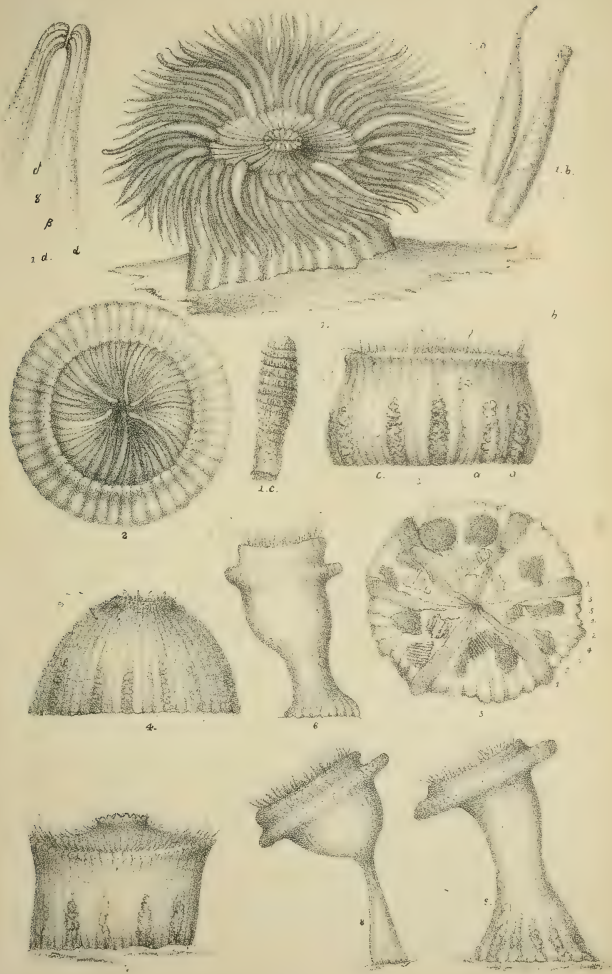




SURVEYED AND DRAWN BY

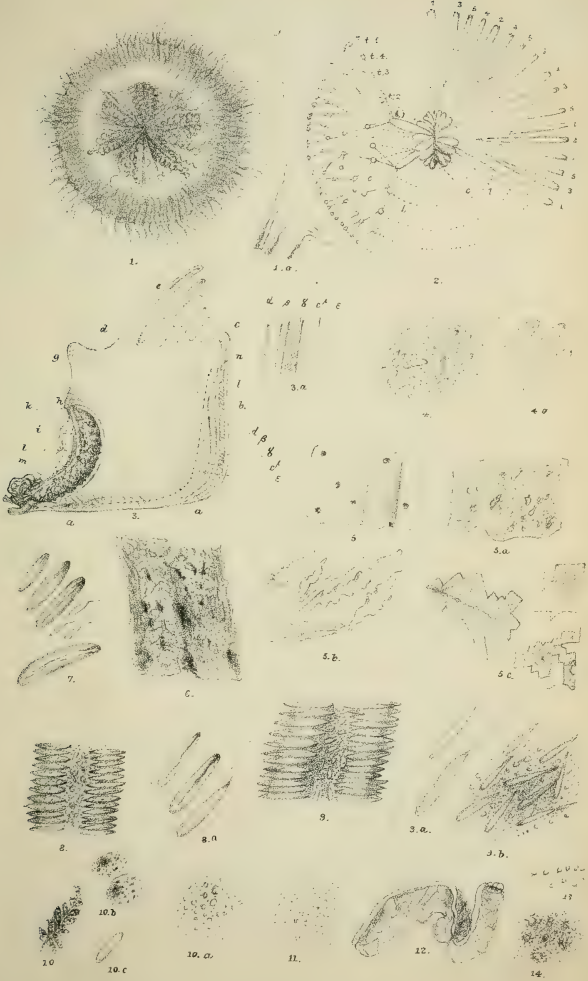
*J. H. Goodwin Austin: Conn.*  
Nov. 1867.



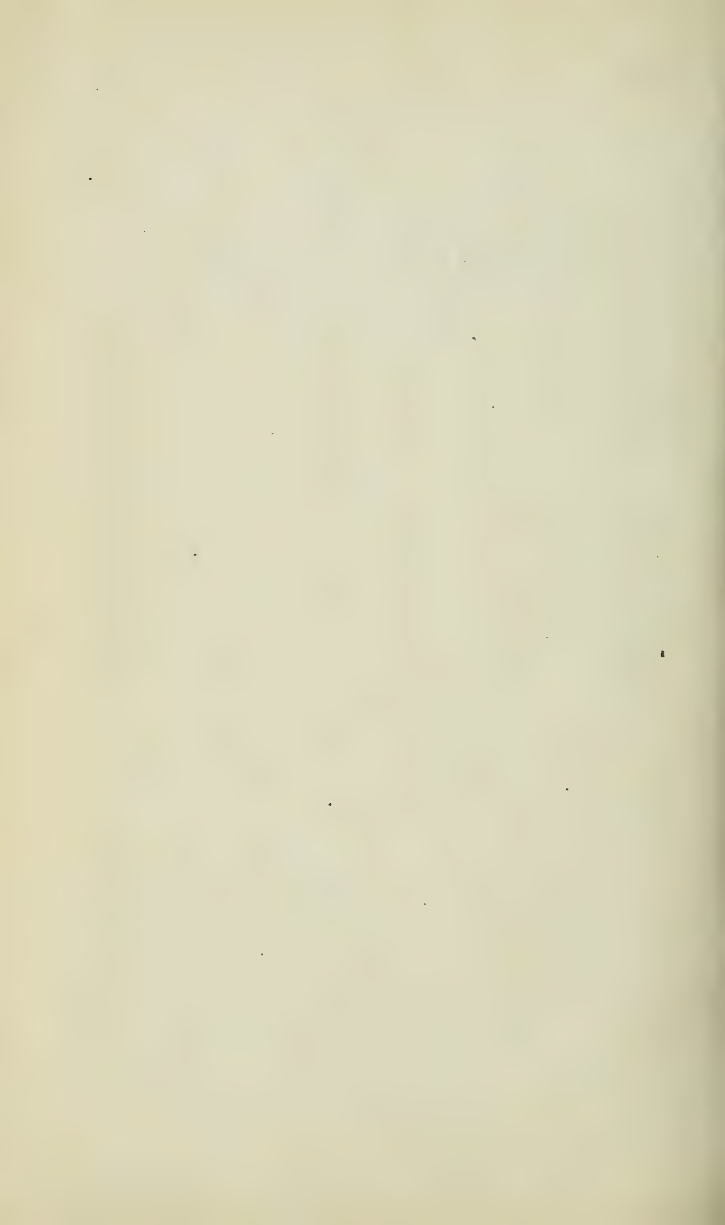


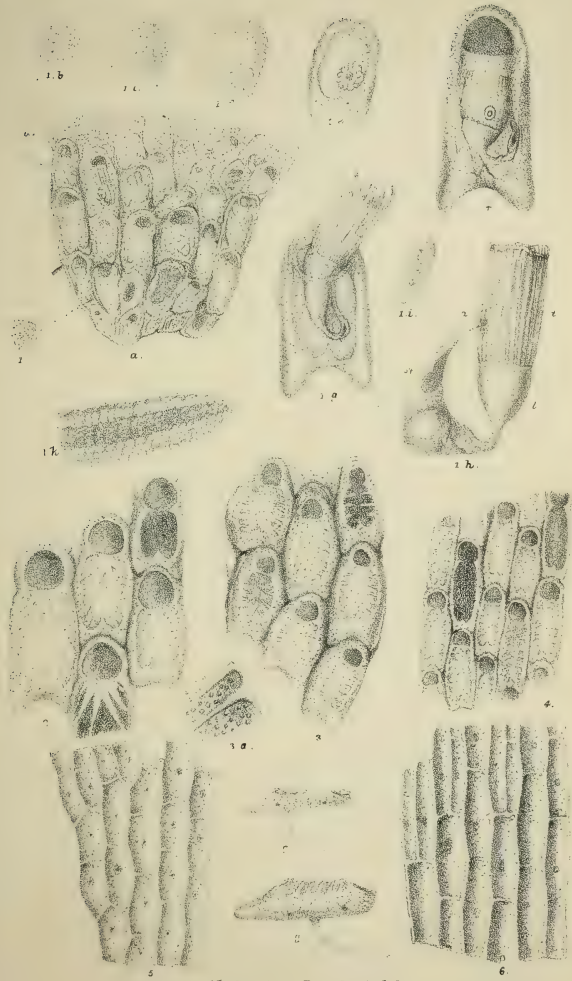
*Sagartia Schilleriana*, Stoll.





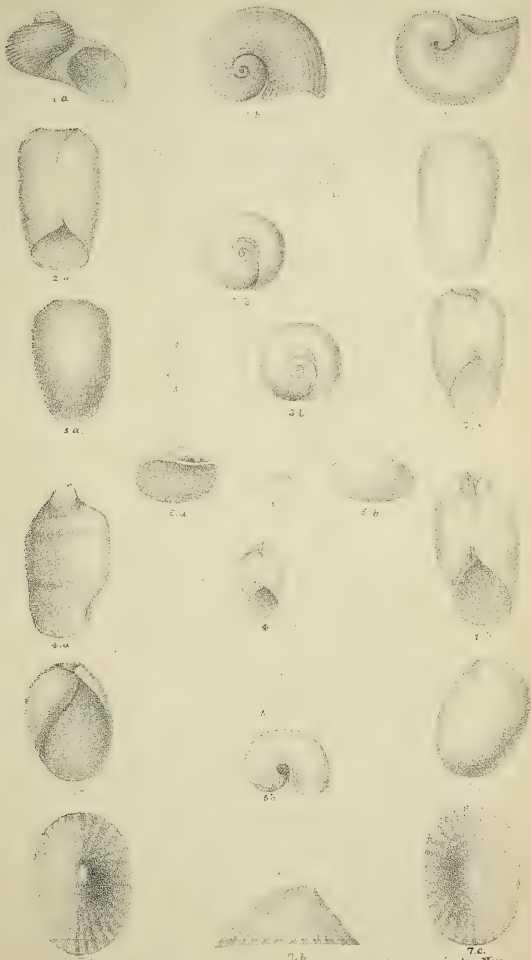
*Sagartia Schilleriana* Stol.





*Membranipora Bengalensis*, Stol.





1. *Cylindrella* *disjuncta* H. A.

2. *Cylindrella* *pusilla*, Nev

3. " *sculpta*, "

7. *Broderipia* *eximia*, Nev.

4. *Cylindrella* *cincta*, Nev.

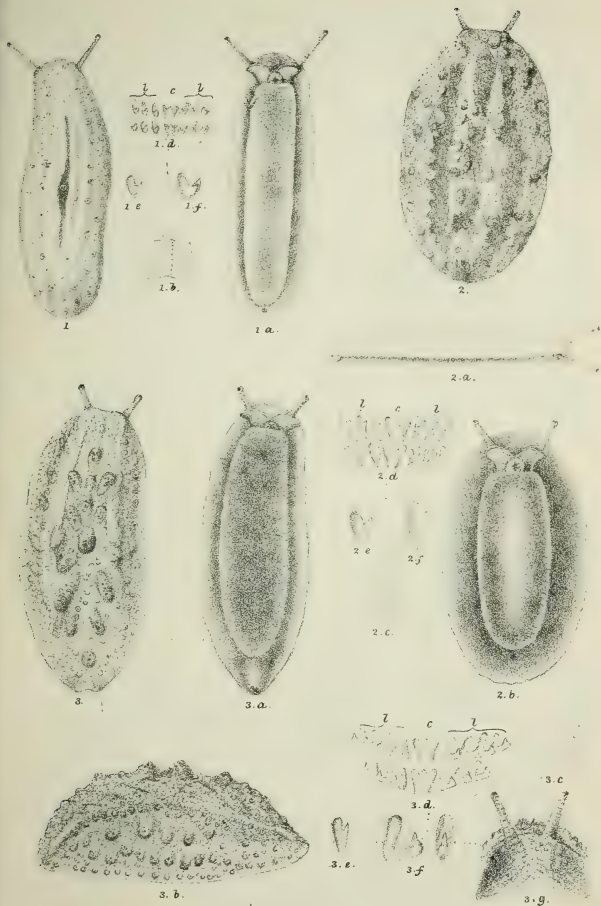
5. " *delicatula*, "

6. *Lobiger* *viridis*, H





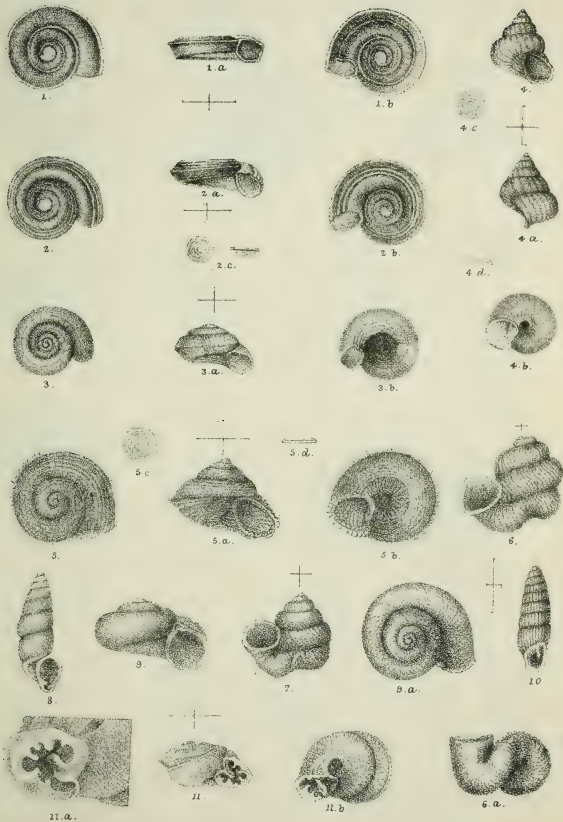




Calcutta

1. *Onch. pallidum*; 2. *Onch. tigrinum*; 3. *Onch. tenerum*.



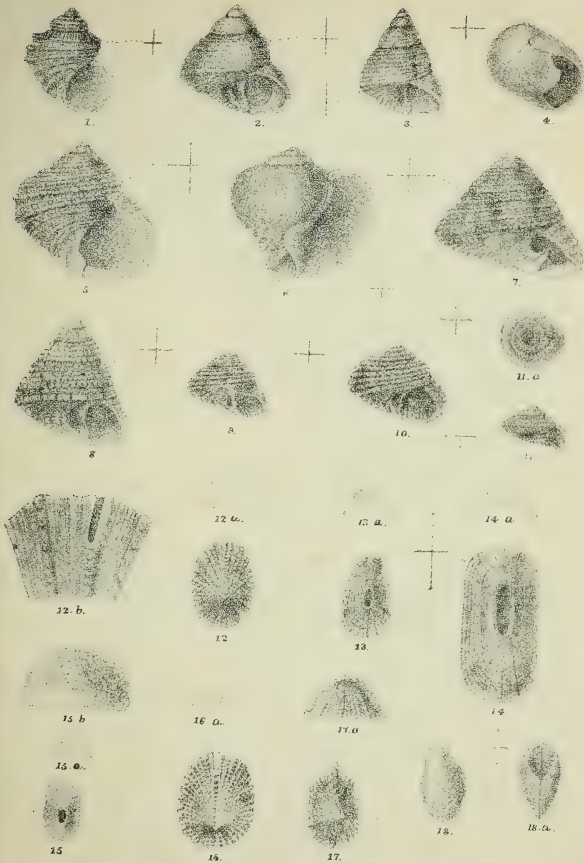


1. *Cyclophorus (Ditropis) planorbis*.
2. *C. (Ditropis) Beddomei*.
3. *C. (Ditropis) convexus*.
4. *Mychopoma limbiferum*.
5. *M. hirsutum*.

6. *Opisthostoma Fairbanki*.
7. *O. macrostoma*.
8. *Cataulius Calcadensis*.
9. *Pterocyclos tristis*.
10. *Ennea sculpta*.

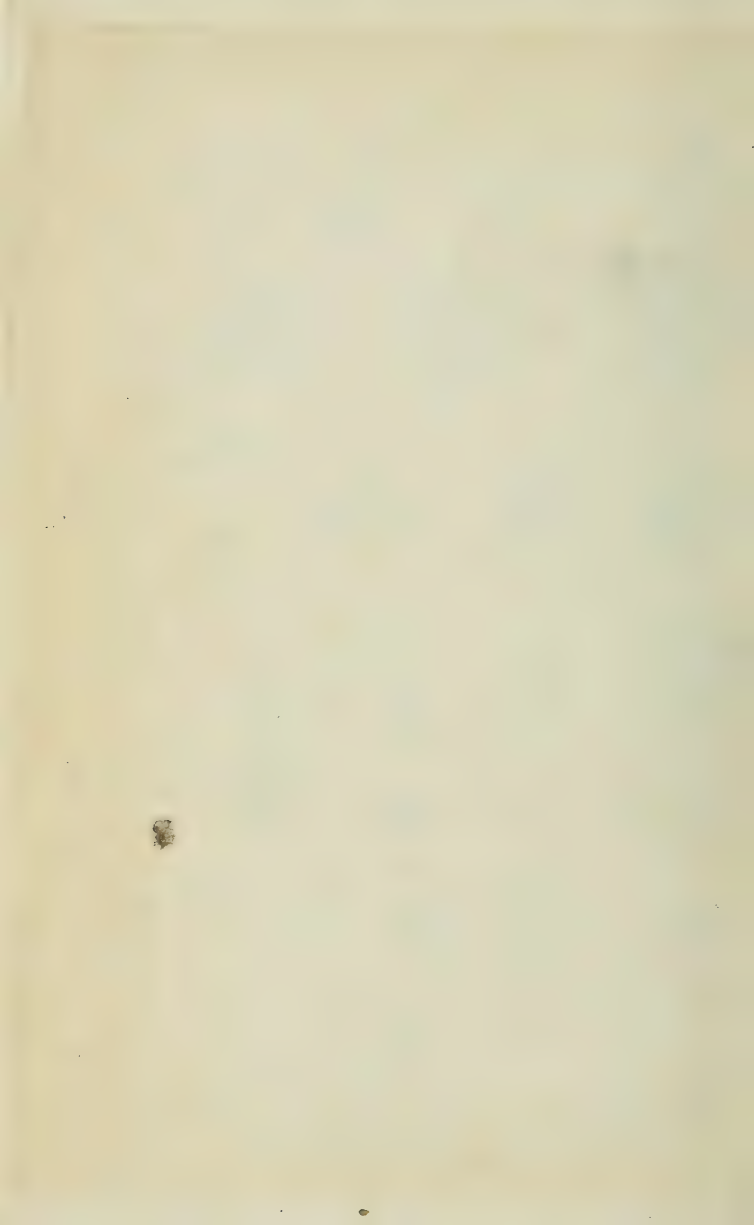
11. *Streptaxis Canarica*.

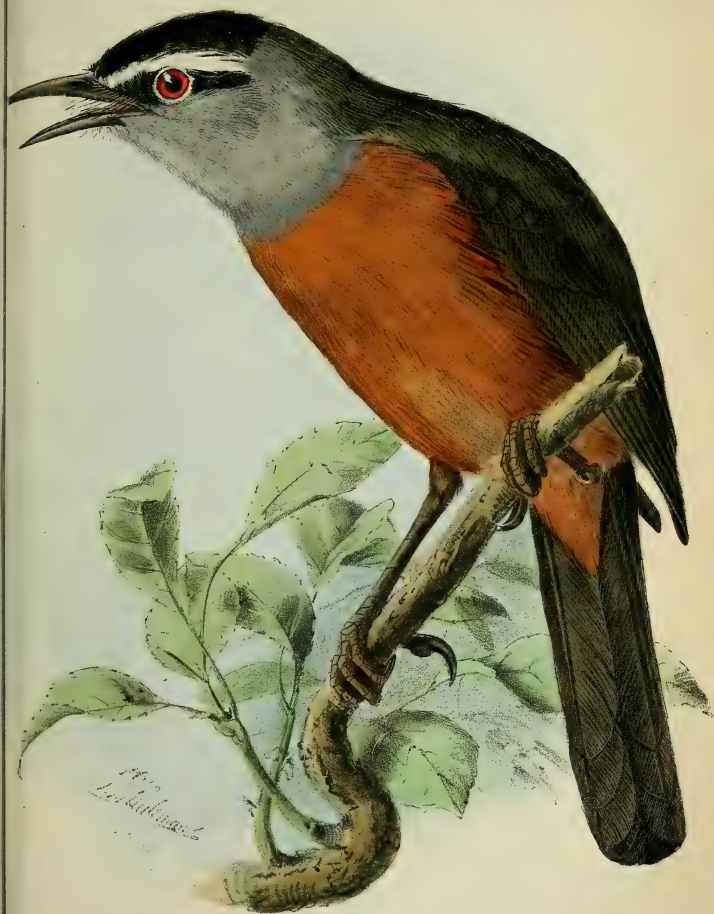




1. *Gibbula* (?) *sub-plicata*
- 2-3. — *Stoliczka*
4. *Pisulina Adamsiana*
5. *Tallorbia roseola*
6. *Rapana bella*
7. *Clanculus Ceylanicus*
8. *Gibbula Dupontiana*
9. — *Elanfordiana*
10. *Eichelus Seychellarum*

11. *Solarium impressum*
12. *Emarginula papilionacea*
13. *Fissurella canalifera*
14. *Macroch. scutiformis*
15. *Fissurella* (?) *scrobiculata*
16. — *capuloidea*
17. *Sub-emarg. Olthamiana*
18. *Rocellaria cordiformis*



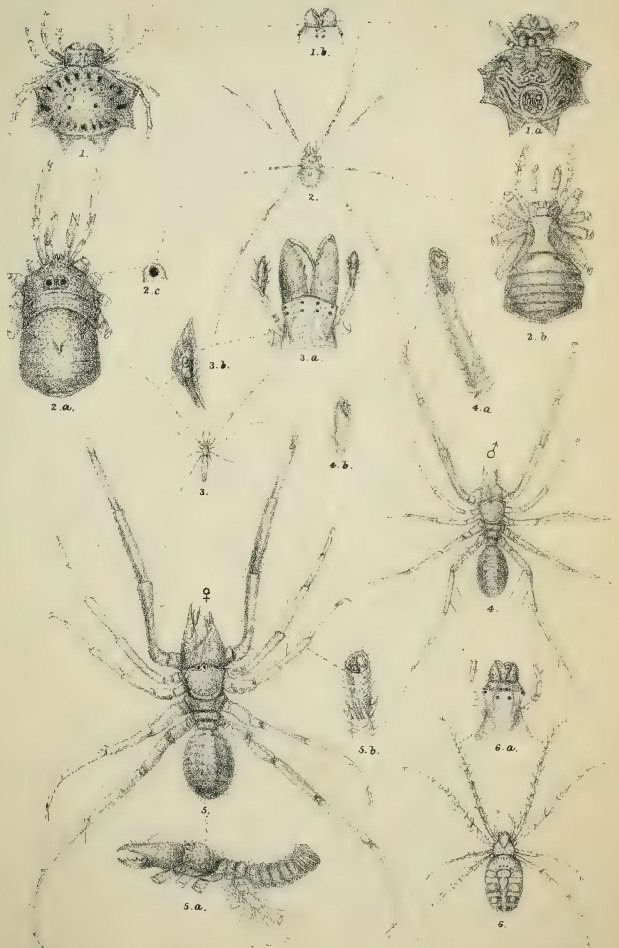


Drawn and lith. by  
G. Keulemans

**TROCHALOPTERON FAIRBANKI.**

Printed and Coloured by  
E. W. M. Trap Leyden



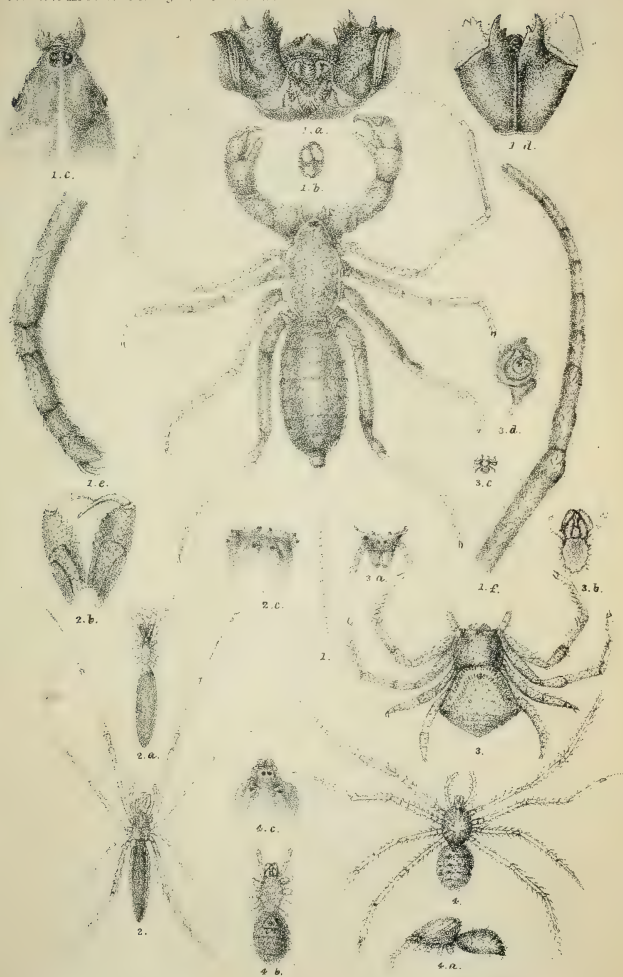


1. *Gastracantha Canningensis*.  
2. *Gagrella atrata*.  
3. *Tetragnatha iridescens*.

4. *Galeodes orientalis*. ♂  
5. ♀  
6. *Epeira (Argyopes) stellata*.

Calcutta.

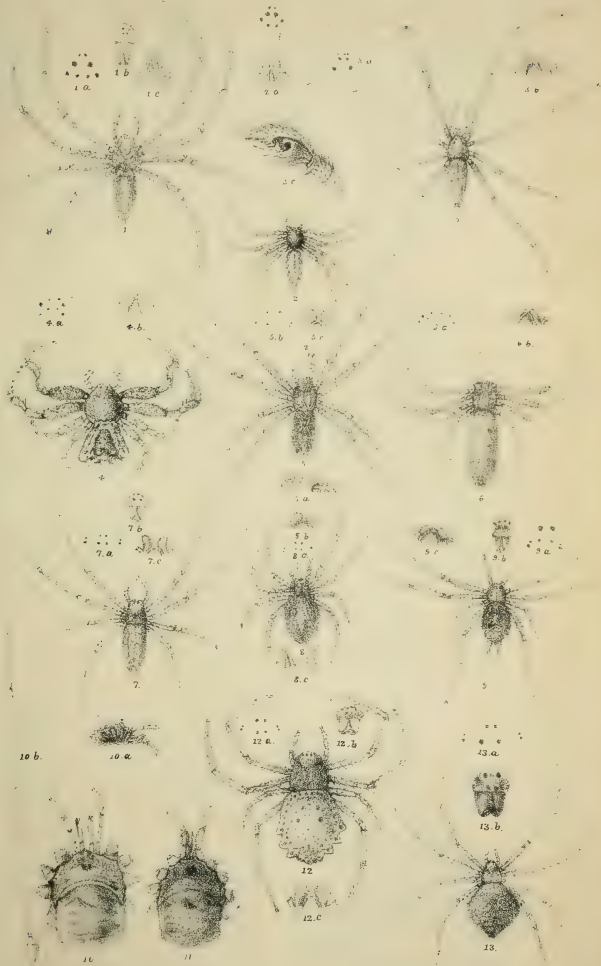




1. *Telyphonus Assamensis*.  
2. *Mela gracilis*.

3. *Thomisus pugilis*.  
4. *Scytodes propinquus*.





- |                               |                                     |
|-------------------------------|-------------------------------------|
| 1. <i>Sphasus viridanus</i> . | 7. <i>Nephila angustata</i> .       |
| 2. — <i>Similaris</i> .       | 8. <i>Epeira braminica</i> .        |
| 3. <i>Helom. longimanus</i> . | 9. <i>Hers. calcullensis</i> .      |
| 4. <i>Thom. Peulianus</i> .   | 10. <i>Gagrella signata</i> .       |
| 5. <i>Epeira cicabresa</i> .  | 11. " <i>atrata</i> .               |
| 6. <i>Thom. elongatus</i> .   | 12. <i>Ep. (Arg.) mammillaris</i> . |
| 13. <i>Epeira hirsutula</i> . |                                     |





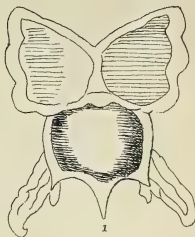
1. a.



1. b.



1. c.



1



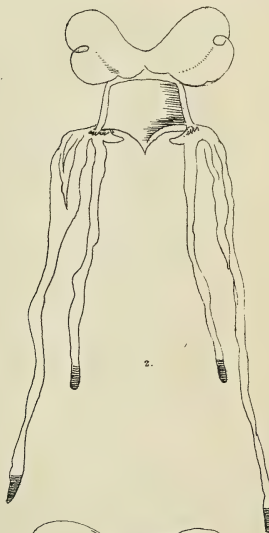
2. a.



2. b.



2. c.



2.



3. a.



3. b.

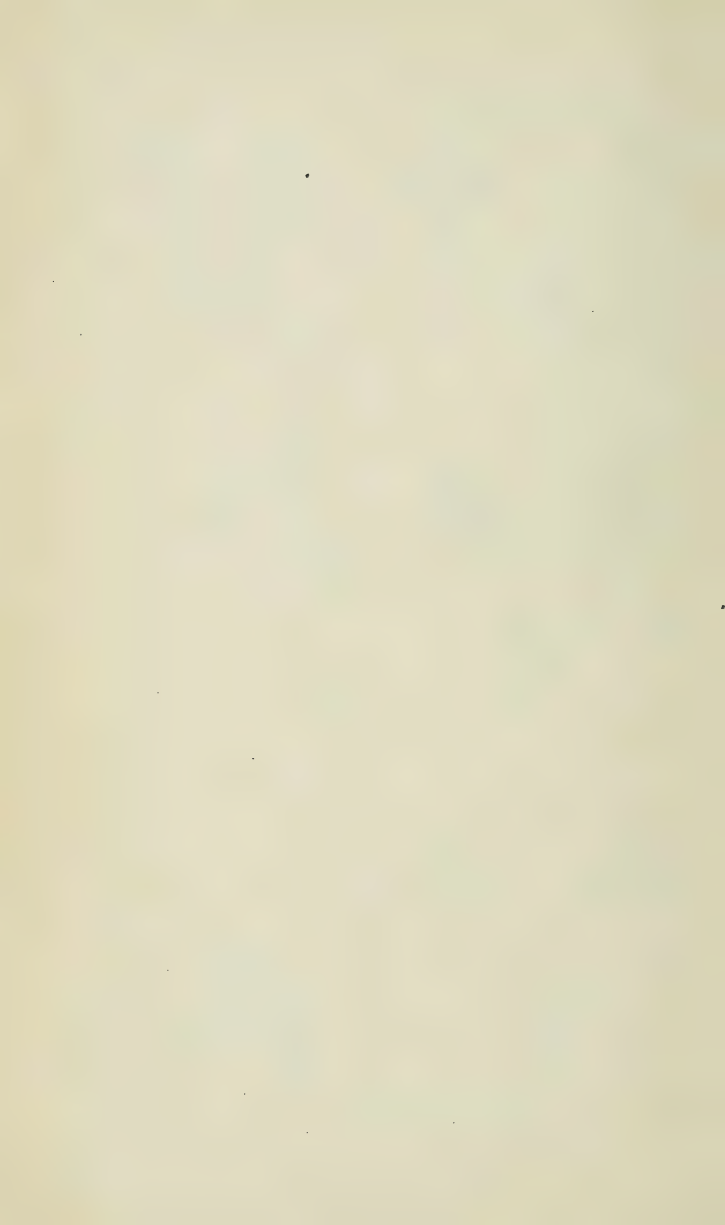


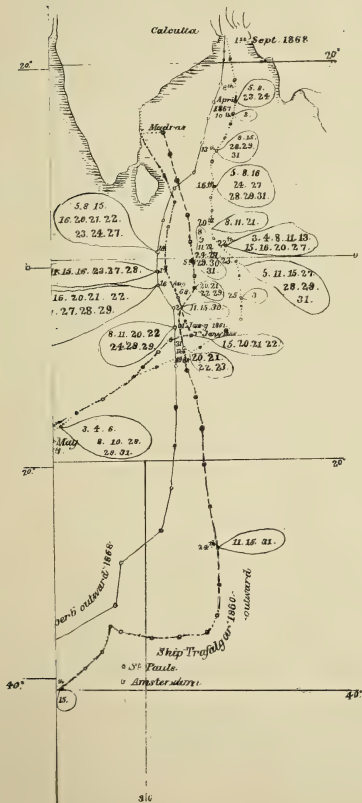
3. c.



3.

1. *Hyalaa tridentata*. 2. *H. teniobranchia*. 3. *H. affinis*.







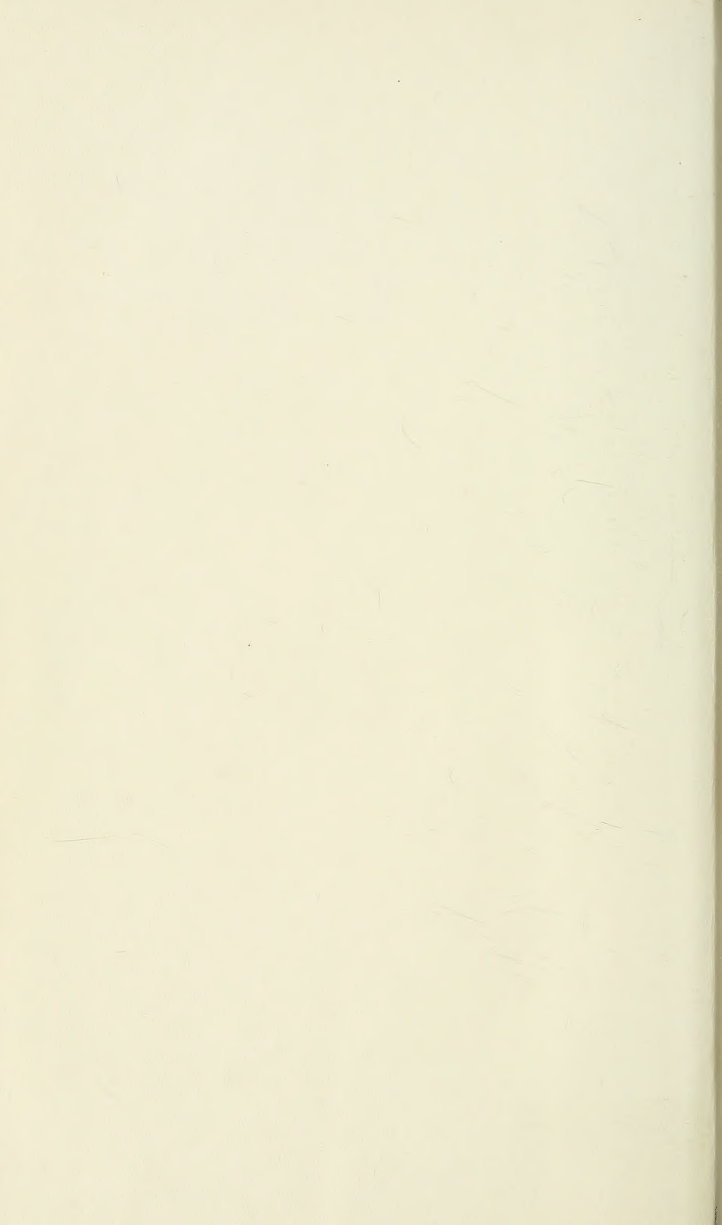












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